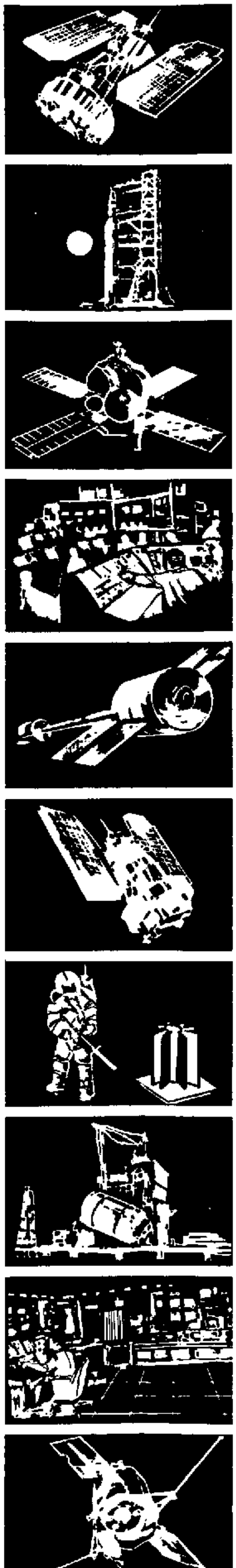
SPACE DIVISION



NASA CR-143706

74SD4255
31 DECEMBER 1974

(NASA-CR-143706) ERTS 1 FLIGHT EVALUATION REPORT, 23 JULY 1974 TO 23 OCTOBER 1974 (General Electric Co.) 130 p HC $5.75 CSCL 22B G3/43 N75-20804 Unclas 18776

ERTS 1 FLIGHT EVALUATION REPORT
23 JULY 1974 TO 23 OCTOBER 1974

Prepared By
GE ERTS OPERATIONS CONTROL CENTER

For

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Goddard Space Flight Center
Greenbelt, Maryland 20771

NASA EARTH RESOURCES TECHNOLOGY SATELLITE

Contract NAS5-21808

GENERAL ELECTRIC

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NASA EARTH RESOURCES • TECHNOLOGY SATELLITE •

SPACE DIVISION
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GENERAL ELECTRIC

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LIST OF ILLUSTRATIONS

INTRODUCTION

This is the tenth report in a continuing series of documents issued quarterly to present flight performance analysis of the ERTS-1 Spacecraft. Previously issued documents are:

72SD4255	ERTS-1 Launch and Flight Activation Evaluation Report 23 to 26 July 1972	18 October 1972
72SD4262	ERTS-1 Flight Evaluation Report 23 July 1972 to 23 October 1972	28 November 1972
72SD4224	ERTS-1 Flight Evaluation Report 23 October 1972 to 23 January 1973	27 February 1973
73SD4249	ERTS-1 Flight Evaluation Report 23 January 1973 to 23 April 1973	29 May 1973
73SD4260	ERTS-1 Flight Evaluation Report 23 April 1973 to 23 July 1973	10 August 1973
73SD4274	ERTS-1 Flight Evaluation Report 23 July 1973 to October 1973	28 November 1973
74SD4205	ERTS-1 Flight Evaluation Report 23 October 1973 to 23 January 1974	26 February 1974
74SD4217	ERTS-1 Flight Evaluation Report 23 January 1974 to 23 April 1974	18 May 1974
74SD4236	ERTS-1 Flight Evaluation Report 23 July 1974 to 23 October 1974	15 August 1974

This report contains analyses of performance for the ninth quarter of operation, i.e., Orbit 10183 to 11466.

SECTION 1

SUMMARY - ERTS-1 OPERATIONS

SECTION 1

SUMMARY - ERTS-1 OPERATIONS

The ERTS-1 spacecraft was launched from the Western Test Range on 23 July 1972 at 18:08:06. 508Z. The launch and orbital injection phase of the space flight were nominal and deployment of the spacecraft followed predictions. Orbital operations of the spacecraft and payload subsystems were satisfactory through Orbit 147 after which an internal short circuit disabled one of the Wideband Video Tape Recorders (WBVTR-2). Operations resumed until Orbit 196 when the Return Beam Vidicon failed to respond when commanded off. The RBV was commanded off via alternate commands and since that time ERTS-1 has performed its mission with the Multispectral Scanner and the remaining Wideband Video Tape Recorder providing image data. The remaining Wideband Video Tape Recorder experienced four suspensions of operation, the last being in Orbit 9881 on 2 July 1974, and has not been used operationally since. In Orbit 4396 an integrated circuit chip in the TMP failed, disabling four TLM functions. COMSTOR "B" has an intermittent problem with cell 12, and is not being used operationally. The "B" section of the USB with full power output of 1.5 watts was substituted for the "A" section in Orbit 10068 because of excessive decline of transmitter power. The pitch flywheel stopped for 2 minutes in Orbit 8040; and for 8 hours, 2 minutes in Orbits 11125 to 11130. It has been kept close to zero speed ever since, using pitch control. The RMP was switched from B to A in Orbit 11257 as a precautionary measure after RMP B began showing operating current variations. Spacecraft performance has not been degraded by these anomalies thus far, except for the inability to record remote MSS imagery.

ORBITAL PARAMETERS

The initial orbit of ERTS-1 required some correction at Orbits 38, 44, and 59 to achieve the desired 18-day repeat cycle. During Orbits 938, 2416, 6390 and 7826 it was necessary to fire the -X thruster of the orbit adjust system to maintain the ground trace in the desired 18-day repeat pattern of $\pm$ 10 nm. On September 29, 1974, the ACS control system fired gas during the spacecraft emergency (pitch flywheel stoppage) which resulted in an unplanned orbit adjustment similar to firing the -X thrusters. During orbits 11367 and 11464 the +X thruster was fired for the first time to maintain the ground trace in the desired 18 day repeat pattern of $\pm$ 10 nm.

POWER SUBSYSTEM

The power subsystem performed well throughout this report period. Solar array current has been slightly lower than predicted. Data from this period shows the array degradation to be -21.8% after 27 months in orbit. The power subsystem will meet ERTS-1 power requirements thru 1976 with the present payload configuration. Battery temperature spread remained low and performance of each battery remained good. During the unscheduled regulator switchover in orbits 10910 and 11035 Regulator number 2 was operated for the first time and performed normally. The spacecraft pitch flywheel emergency (orbits 11128 and 11131) exercised the power system severely and the regulated voltage decreased to 24.3 volts just prior to re-acquisition due to deep battery discharge while the solar panels lost sun track due to loss of normal spacecraft attitude. The power subsystem and spacecraft performed well throughout the emergency except for the pitch flywheel.

ATTITUDE CONTROL SUBSYSTEM

From initial acquisition, the ACS performance has been excellent except between orbits 11125 and 11130 when the pitch flywheel stopped and restarted approximately 8 hours later. All functions are active and within specifications at the end of this report period. The Pitch Flywheel stoppage caused loss of attitude and required use of a large quantity of Freon control gas to reacquire normal attitude which was achieved after the pitch flywheel restarted. The Freon gas expended causing an increase in semi-major axis similar to a -X thruster orbit adjustment. Pitch flywheel speed, after orbit 11130, is operated between -100 and +100 rmp by use of Pitch Position Bias which eliminates pitch gating. Gating frequency in both Roll and Pitch increased during this period similar to previous years performance. After the failure Roll gates continued at the same gating frequency. Perturbations due to sun glint in the IR horizon scanners are not disruptive enough to necessitate single scanner mode. The RMP was switched from B to A as a precautionary move when the operating current of B showed small variations. The Forward IR Scanner pressure has decreased slightly (4.6 PSIA at launch, 3.33 PSIA at orbit 11456).

COMMAND/CLOCK SUBSYSTEM

All stored commands and real time commands have executed except for the expected one-in-approximately 10,000 associated with the logic race conditions. No serious problems have resulted from these few commands failing to execute. Use of cell 12 COMSTOR "B" has been discontinued for active commands because of intermittent time delta errors of 256 seconds. Occasionally stored commands are blocked by real-time sequences which overlap in time. Specific cause has not been determined. The VHF command receiver was switched from side B to side A at the time of USB subsystem switchover to side B. The PCM regulators switched, without Commands, from Unit 1 to 2 in Orbit 10910 on September 14, and back from 2 to 1 in Orbit 11035 on September 23. VHF input signal transients in the command channel are believed responsible.

TELEMETRY SUBSYSTEM

The telemetry subsystem has consistently performed in an excellent manner. Memory Section 0, 0 has been in use since launch. All dropouts have been associated with known link or ground problems. Except for failure of an integrated circuit chip in the TMP (Orbit 4396), disabling four telementry functions, all functions have performed in a nominal manner.

ORBIT ADJUST SUBSYSTEM

The orbit adjust system has been fired nine times, seven times using the -X thruster and two times using the +X thruster. Three -X fringes were for initial orbit corrections and six -X for orbit maintenance. A 8.0 second burn was executed in Orbit 11367 and a 8.4 second burn was executed in Orbit 11464 using the +X thruster for the first time. All functions were normal with the expected ephemeris changes being achieved. Pressure/temperature parameters continue to be normal.

MAGNETIC MOMENT COMPENSATING ASSEMBLY

The Magnetic Moment Compensating Assembly has been operated six times during this period and performance was excellent. There has been a total of eleven operations since launch. It has held the Pole-Cm commanded in prior orbits and the new values recently obtained. Status telemetry values continue to be normal.

UNIFIED "S" BAND/PRE-MODULATION PROCESSOR

The Unified S-Band Subsystem has operated satisfactorily since launch. On Orbit 10068 the B-Section was substituted for the A-Section because the A-transmitter power output had declined from 1.6 watts at launch to 0.14 watts with noticeable loss of DCS coverage. The B-transmitter with a power output of 1.5 watts has operated without power drop since turn ON.

ELECTRICAL INTERFACE SUBSYSTEM

The Auxiliary Processing Unit (APU), Interface Switching Module (ISM) and Power Switching Moduls (PSM) performed normally in this report period. The RBV switching relay (within the PSM) failed in Orbit 196. The APU was turned off during the power (pitch flywheel) emergency and resumed normal operations when the emergency terminated.

THERMAL CONTROL SUBSYSTEM

The thermal subsystem performed normally throughout this period. Temperatures increased slightly due to increasing sun intensity but had no noticeable effect on operation. Temperatures held within limits during the minimum spacecraft operation in effect during the power (pitch flywheel) emergency.

NARROWBAND TAPE RECORDER SUBSYSTEM

The Narrowband Tape Recorder Subsystem has continued to operate satisfactorily without incident. The total ON time is 10,355 hours for each recorder (A and B).

WIDEBAND TELEMETRY SUBSYSTEM

The Wideband Telemetry Subsystem has continued to operate satisfactorily. The power output has continued at 20 watts since switching to that mode in Orbit 30. WPA-2 is currently in use. WPA-1 was used with RBV to Orbit 196 and subsequently between Orbits 1890 and 2099 with MSS during Apollo 17 operations.

ATTITUDE MEASUREMENT SENSOR

The AMS continues to function normally in all aspects. The AMS was turned off for the duration of the pitch flywheel emergency and resumed normal operation thereafter.

WIDEBAND VIDEO TAPE RECORDERS

Wideband Video Tape Recorder-2 failed after 10 days in orbit. Wideband Video Tape Recorder-1 has 3 prior gaps in its satisfactory performance since launch, and again has been temporarily removed from service since Orbit 9881 pending study of corrective action.

RETURN BEAM VIDICON

The Return Beam Vidicon has been idle since Orbit 196 when its prime input power switching relay failed. RBV performed satisfactorily up to that point and is available for use, if needed, by an alternate switching mode.

MULTISPECTRAL SCANNER SUBSYSTEM

The Multispectral Scanner Subsystem continues to operate in a completely satisfactory manner. It has imaged more than 27% of the earth's surface (including water) between the latitudes of 81.42°, including 78% of the continents, with a cloud cover of 30% or less. All units of the Subsystem are normal and stable.

DATA COLLECTION SYSTEM

The Data Collection Subsystem continues continues to operate satisfactorily. Only Receiver A has been used to date. The DCS was turned off for the duration of the pitch flywheel emergency and resumed normal operations thereafter.

PAYLOAD OPERATION SUMMARY
(Launch through Orbit 11460)

Subsystem	Orbital On-Time HH:MM:SS	Operational Summary	
RBV	13:59:09	Total scenes photographed	1,690
		Average scenes per day	139
		Total area photographed (millions of square nautical miles)	14.7
		ON-OFF cycles	91
		% Real Time scenes	57
		% Recorded scenes	43
MSS	1556:55:08	Total scenes photographed	147,672
		Average scenes per day	180
		Total area photographed (millions of square nautical miles)	1,287.64
		ON-OFF cycles	11,984
		% Real Time scenes	68
		% Recorded scenes	32
DCS	19704:55:14	Messages received at OCC	1,058,746
		Non perfect messages	85,246
		Maximum Ground platforms active/day	110
		Users	43
		Average messages per orbit	184
WBVTR-1	891:44:40	% Record Mode	38
		% Playback Mode	41
		% Rewind Mode	20
		% Standby Mode	1
		Minor Frame Sync. Error Count during Playback	150
		Time Video Head-to tape contact	732:48:36
		Cycles of Head-to tape contact	11,954
WBVTR-2	9:26:33	% Usage same as WBVTR-1 Failed in Orbit 148/9	
WPA-1	31:55:09	% Real Time Mode	55
		% Playback Mode	45
		(Used in Orbits 5 thru 196 and 1890 thru 2099)	
		ON-OFF cycles	311
WPA-2	1512:55:48	% Real Time Mode	68
		% Playback Mode	32
		(Used in Orbits 5 thru 1899 and since 2100)	
		ON-OFF cycles	9,565

SECTION 2

ORBITAL PARAMETERS

SECTION 2

ORBITAL PARAMETERS

ERTS-1 launch and injection was satisfactory and required only a minor orbit adjust to achieve normal parameters. These adjustments were made in Orbits 38, 44 and 59. After several 18-day repeat cycles, orbit maintenance burns were made in Orbit 938, 2416, 6390, 7826, 11367 and 11464. An unplanned orbit adjust occurred due to freon gas expended during the pitch flywheel emergency (Orbits 11125 to 11130).

The orbital parameters are given in Table 2-1. Figure 2-1 shows the sub-satellite plot and Figure 2-2 shows the longitude error as a function of time and orbit maintenance burns. The longitude error has been maintained within the ±10 nm average in the east-west direction at the equator as planned. Figure 2-3 shows the change of sun time at the descending node equator crossing. Appendix B gives ground trace repeat cycle predictions.

Table 2-1. Brouwer Mean Orbital Parameters

Element			25 Oct 1972	26 Jan 1973	25 Apr 1973	25 July 1973	25 Oct 1973	25 Jan 1974	24 Apr 1974	23 July 1974	23 Oct 1974
(1)	Apogee	KM	917.3	922.3	911.056	914.341	922.013	915.873	920.090	922.363	918.657
(2)	Perigee	KM	898.1	893.1	888.763	900.810	893.229	899.111	912.672	892.629	896.316
(3)	Inclination	deg	99.103	99.090	99.073	99.068	99.056	99.041	99.023	99.017	99.004
(4)	Semimajor Axis	KM	7,285.850	7,285.865	7,285.767	7,285.741	7,285.786	7,285.657	7,285.691	7,285.661	7,285.652
(5)	Eccentricity	---	0.00132	0.00200	0.00073	0.00093	0.00198	0.00115	0.000802	0.002041	.00153
(6)	Anomalistic Period	min	103.152	103.153	103.151	103.150	103.151	103.148	103.149	103.148	103.148
(7)	Nodal Period	min	103.268	103.268	103.267	103.266	103.268	103.264	103.265	103.264	103.264
(8)	Argument of Perigee	deg	93.721	133.693	168.857	95.602	65.071	160.886	117.631	109.225	150.750
(9)	Right Ascension	deg	1.060	91.805	181.411	268.944	0.2912	88.606	176.743	269.779	354.743
(10)	Mean Anomaly	deg	86.484	52.797	11.098	84.301	301.002	19.049	62.319	70.540	29.110

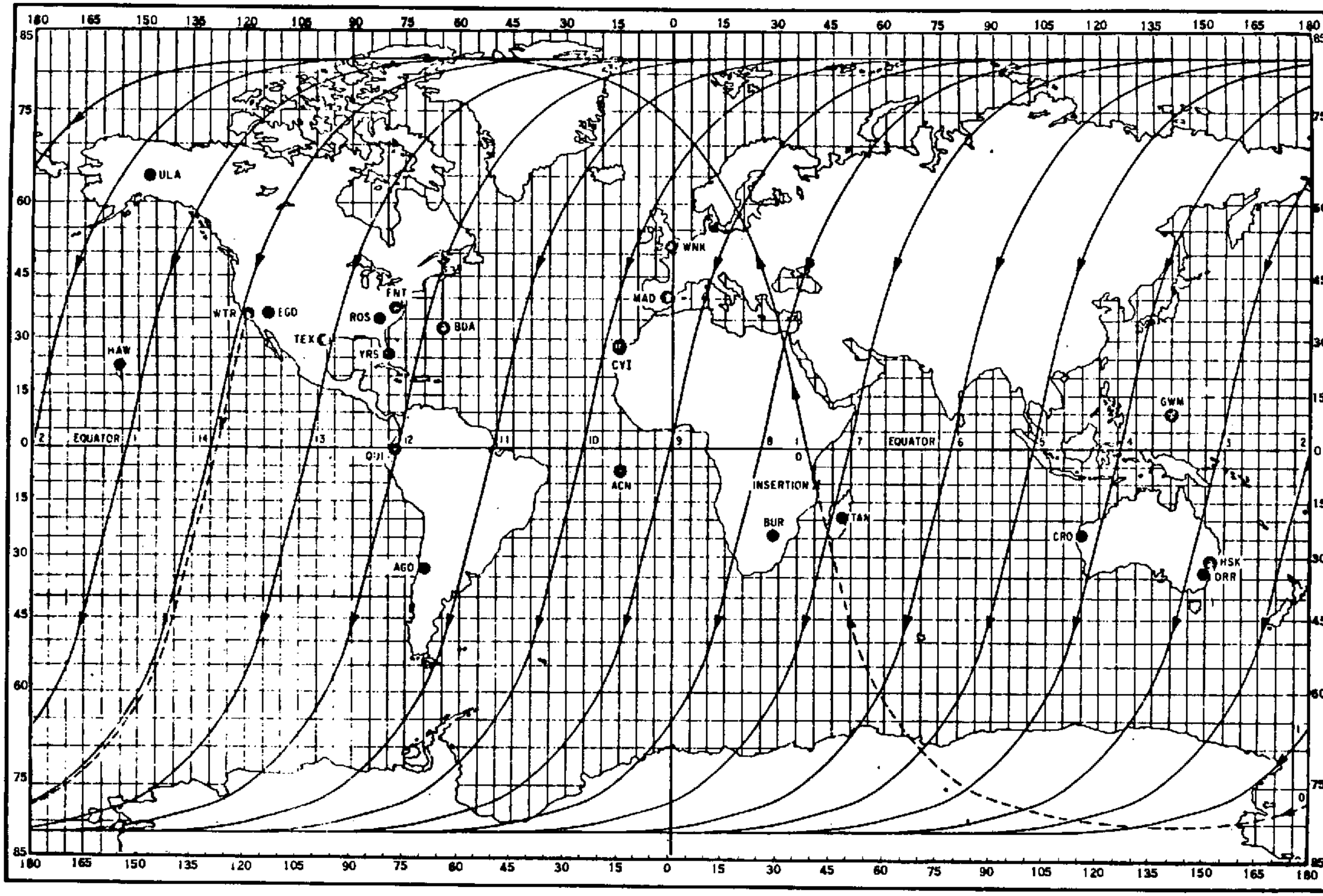

Figure 2-1. Typical Subsatellite Plot of the ERTS-1 Spacecraft

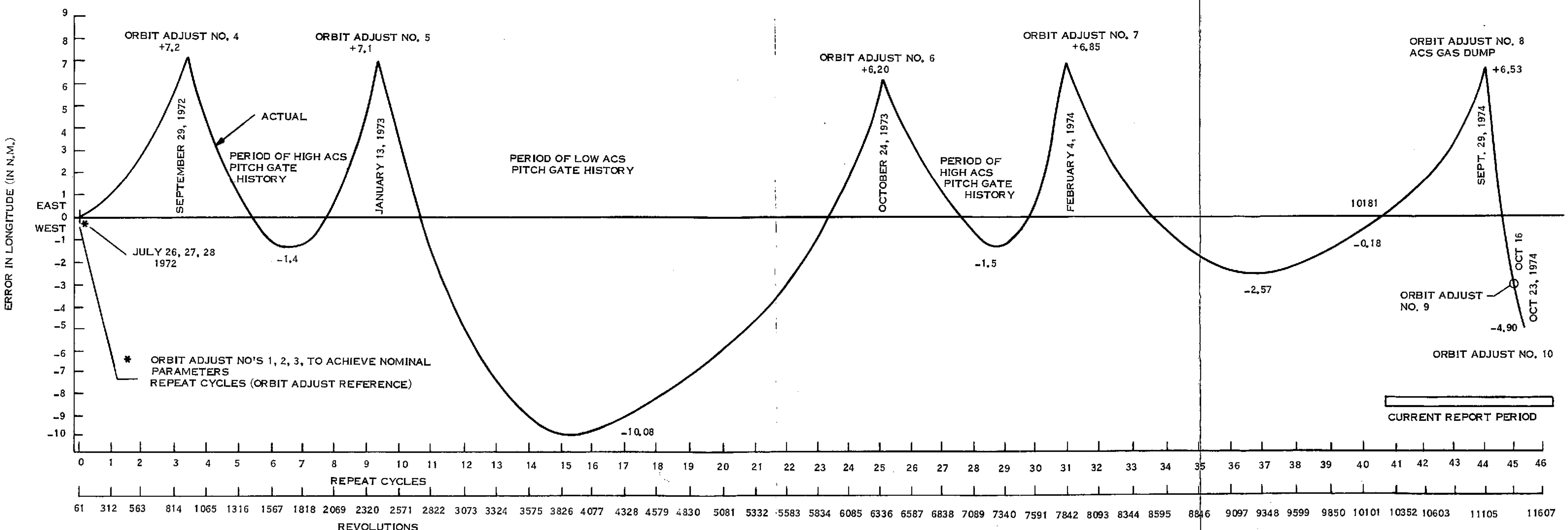

Figure 2-2. Effects of Orbit Adjust on Ground Track

FOLDOUT FRAME 1

FOLDOUT FRAME 2

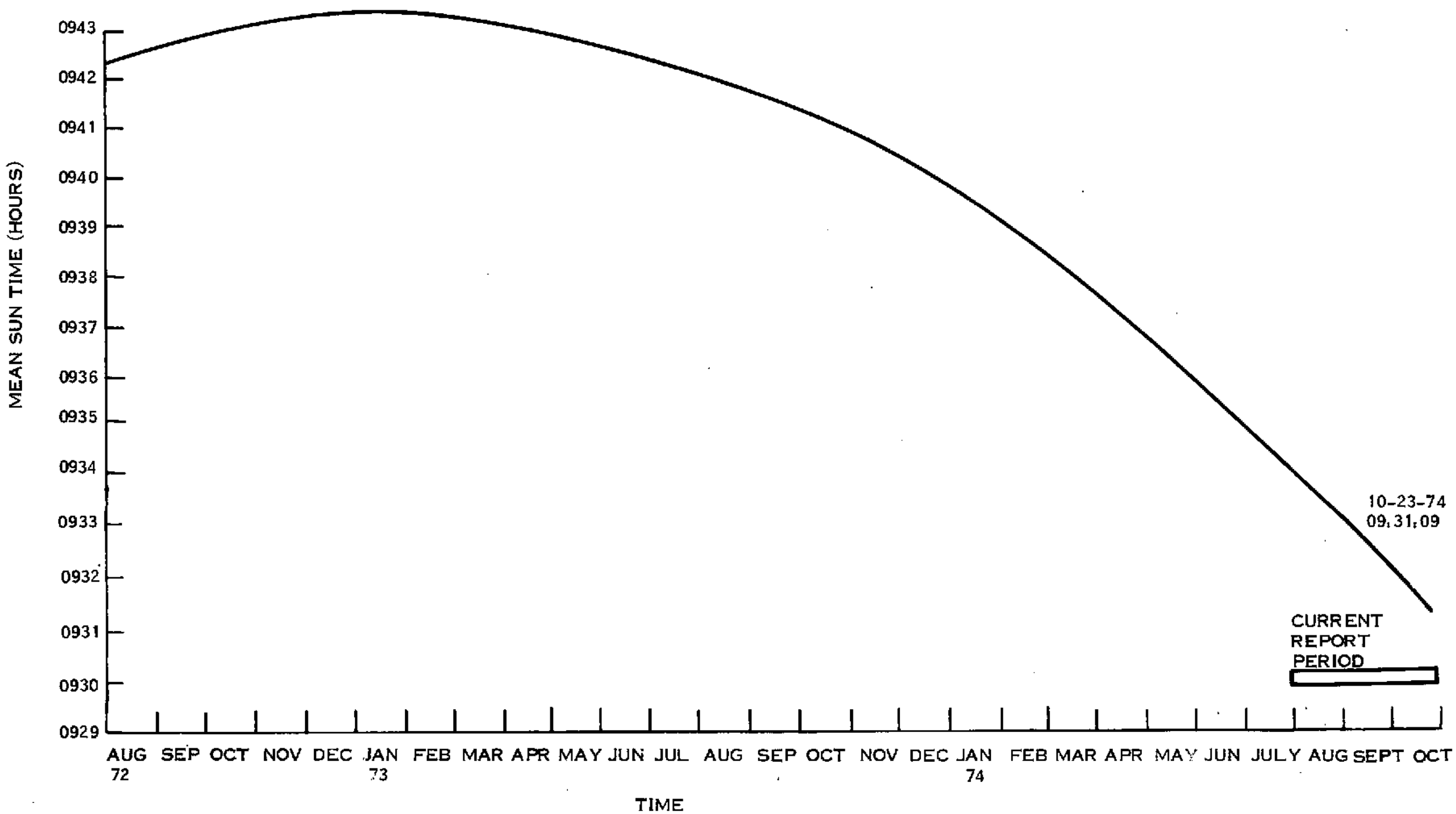

Figure 2-3. Mean Sun Time Equator Crossing-Descending Node

SECTION 3

POWER SUBSYSTEM (PWR)

SECTION 3
POWER SUBSYSTEM (PWR)

The solar array continued to provide excess energy for the payload and spacecraft load throughout this report period. Compensation loads and auxiliary loads dissipated the excess power above the battery and load requirements using ERTS-1 power management procedures. Midday measured solar array current tracked slightly below the values predicted earlier due to higher than predicted beta angle variations. Solar array degradation was -21.8% at the end of 27 months in orbit. The power subsystem is predicted to have adequate power through 1976 for the present ERTS-1 payload configuration and may extend to 1977 and 1978 depending on the electro-chemical degradation of the battery packs for that period.

A plot of measured and predicted midday solar current is shown in Figure 3-1. Figure 3-2 shows actual and predicted solar array current degradation. Figure 3-3 shows actual sun angles to the spacecraft and solar panels. Figure 3-4 shows seasonal solar intensity variation. It is noted on Figure 3-1 that the high noon solar array current is slightly lower than predicted. This is due to slightly different solar panel sun angles and operating point high noon solar array degradation than initially predicted.

Battery packs ranged from 9.8 to 11.2 percent depth of Discharge (DOD) with an average of 10.0 over a 24-hour period of normal operation. Temperature spread between batteries increased to 6.1 degrees C during this report period due to increasing sun intensity. Charge and load sharing were satisfactory.

The power system electronics performed well in this report period with all voltages stable. Table 3-1 shows major power subsystem parameters and Table 3-2 shows power subsystem telemetry for selected orbits. Some parameters in Table 3-2 may be slightly different than Table 3-1 because Table 3-1 uses a time span for power management (night followed by a day) different from the time span which is used in Table 3-2 which is the playback period from the NBTR. The Shunt Limiter has not operated since Orbit 3 because the unregulated voltage has been held below cut-in voltage by power management.

During the Pitch Flywheel Anomaly the solar panels lost sun track due to the off-normal attitude of the spacecraft. This caused day as well as night battery discharge. The power system discharged to an unregulated bus voltage of -25.3 volts at which time the regulated bus voltage decreased from its normal -24.5 volts to -24.3 volts. Upon acquisition of normal spacecraft attitude, sun lock was again achieved and the power system returned to normal with no ill effects. During the anomaly the spacecraft went to minimum spacecraft load with everything off (including Narrow Band Recorders), except the comdecs, in order to stretch the available battery charge to its maximum time span in maintaining regulated voltage. This permitted additional time for attitude control analysis before implementing corrective action for the anomaly.

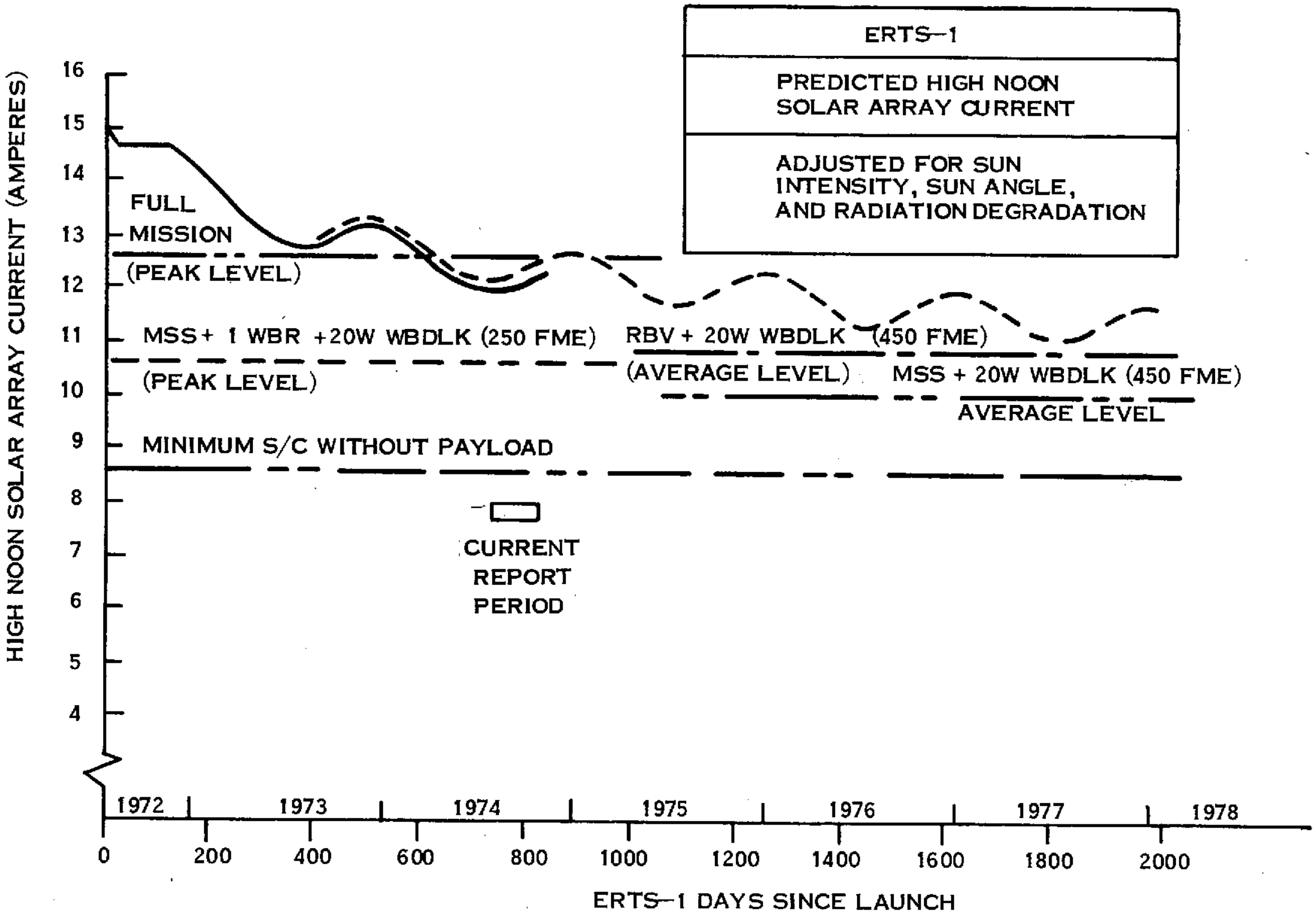

Figure 3-1. Predicted Midday Solar Current

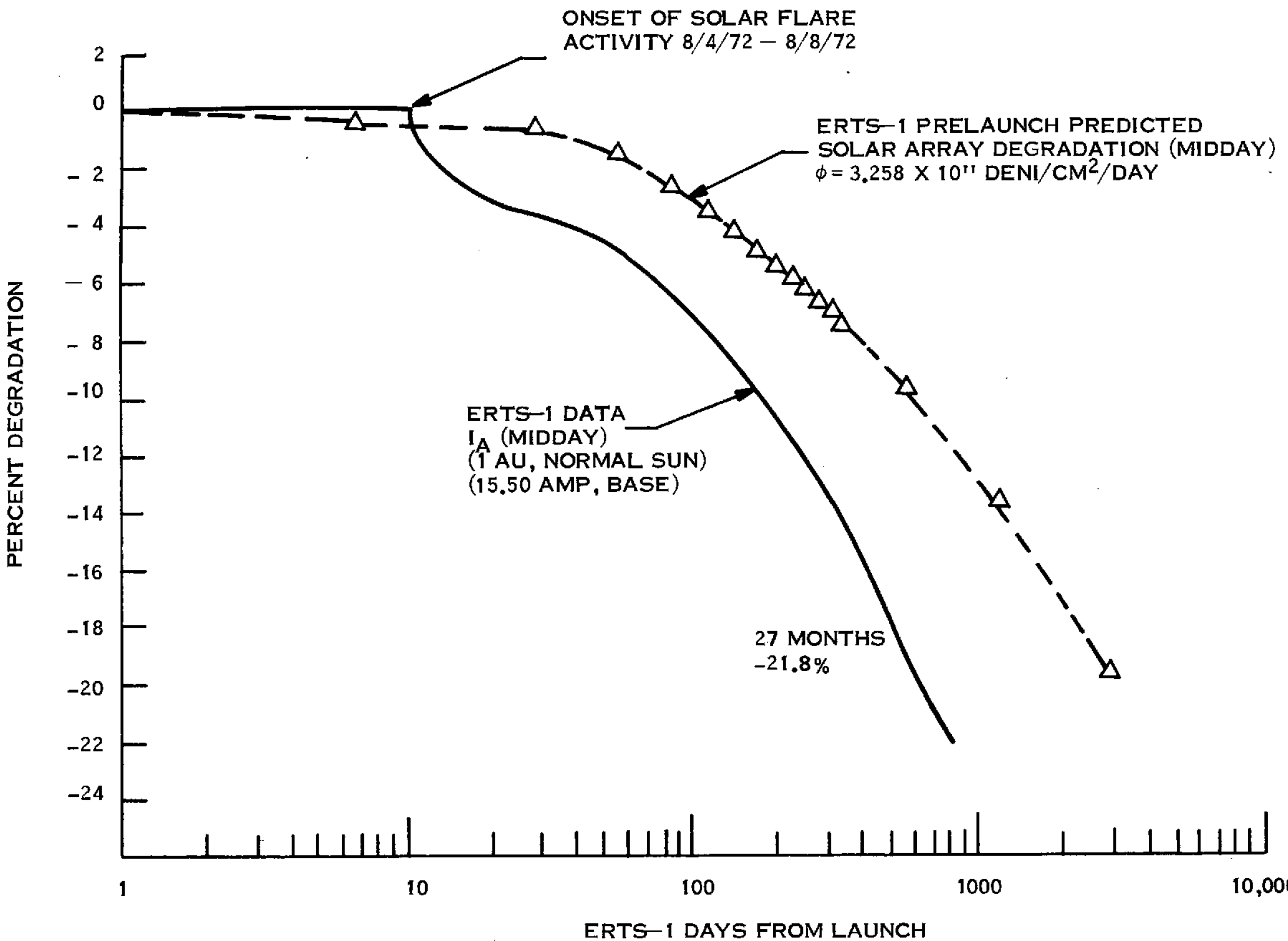

Figure 3-2. IA (Midday) Degradation vs. Days

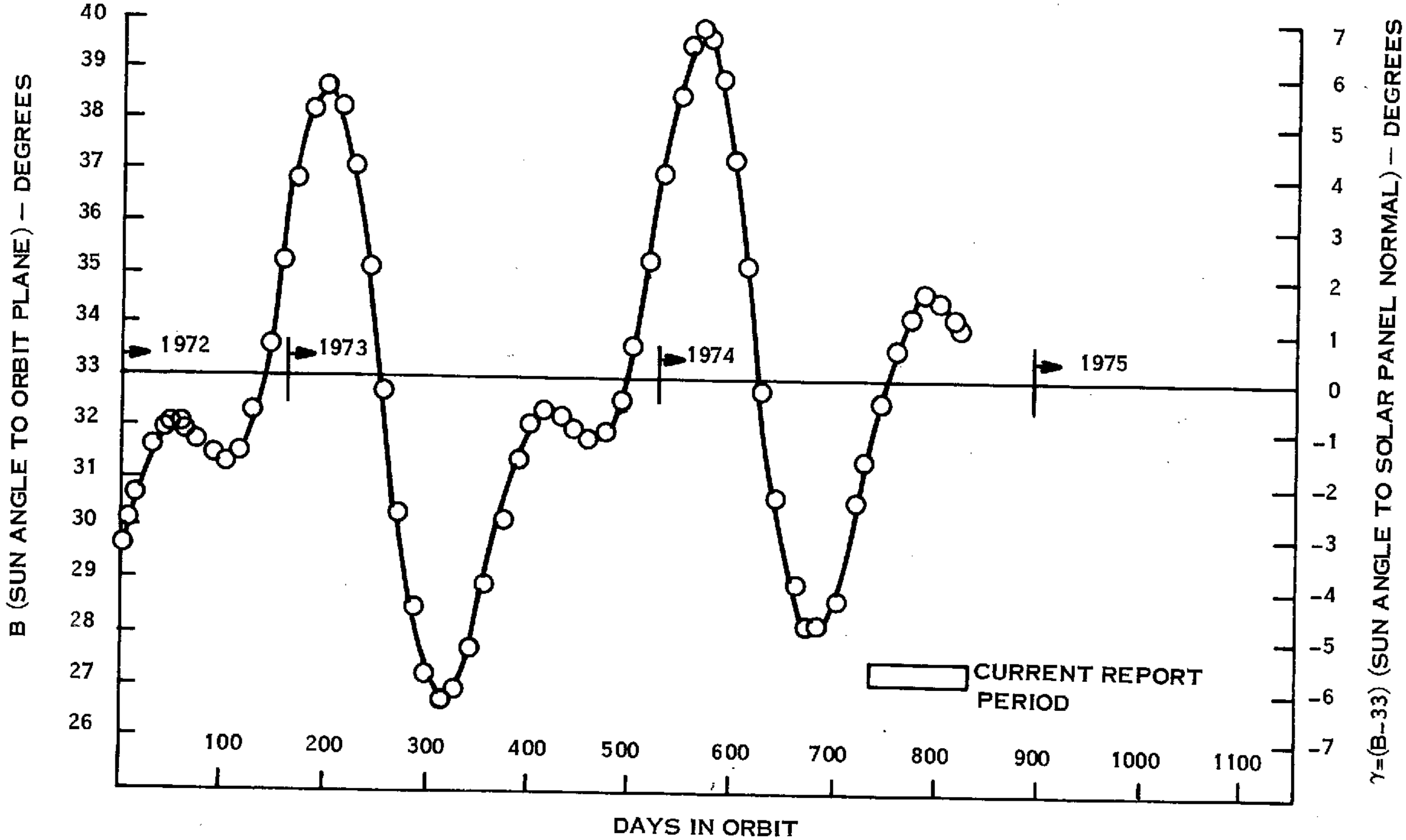

Figure 3-3. Actual β and γ (Paddle) Sun Angles

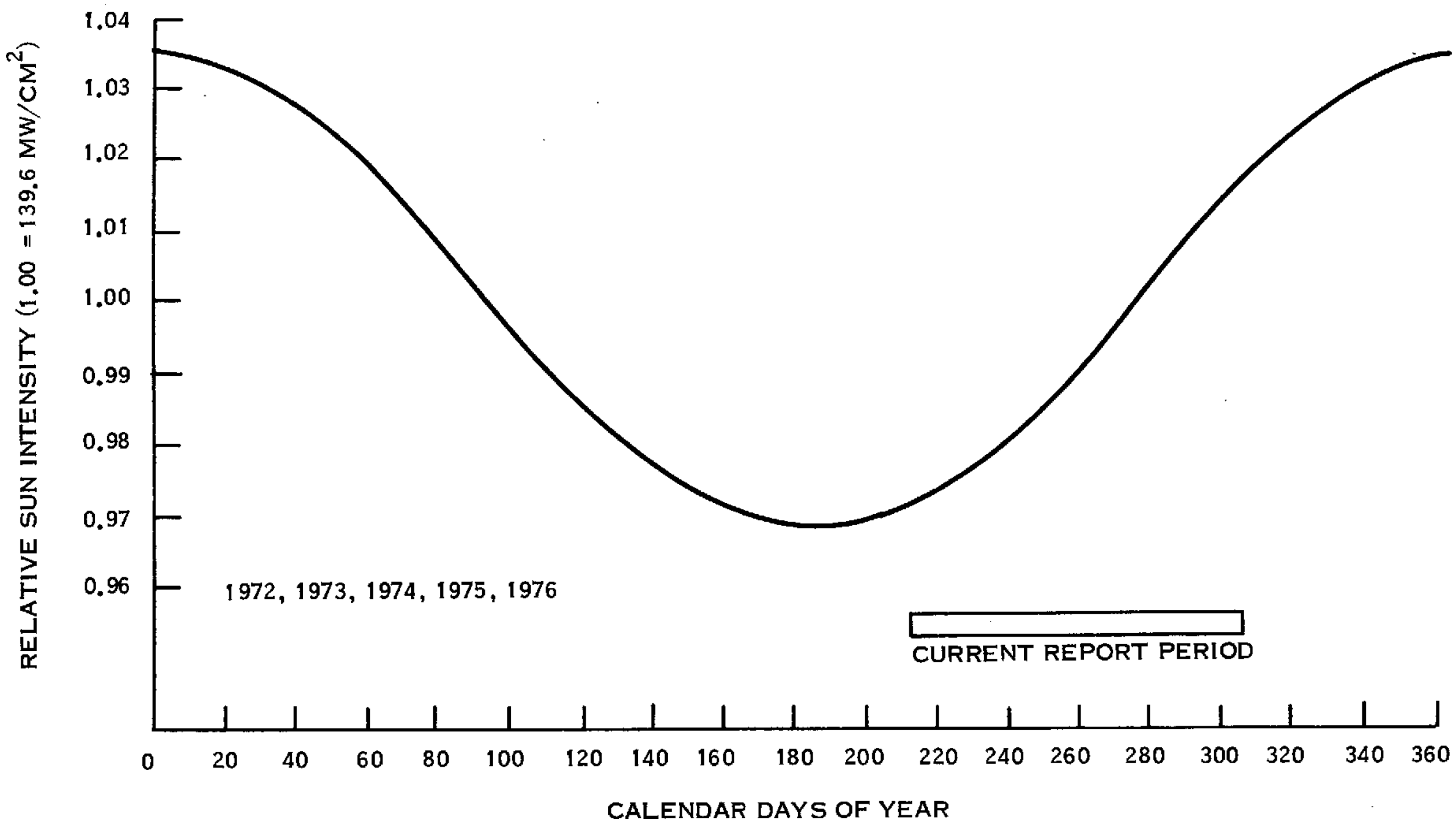

Figure 3-4. Seasonal Solar Intensity Variations

Table 3-1. Major Power Subsystems Parameters

ORBIT NO.	26	2600	5098	7650	10178	10597	11028	11456
BATT 1 MAX	32.48	32.91	32.91	32.73	33.25	33.25	32.99	32.82
2 CHGE	32.48	32.91	32.91	32.73	33.16	33.25	32.99	32.82
3 VOLTS	32.48	32.91	32.99	32.73	33.25	33.25	32.99	32.91
4	32.48	32.48	32.99	32.73	33.25	33.33	32.99	32.91
5	32.48	32.99	32.99	32.82	33.33	33.33	33.08	32.91
6	32.31	32.91	32.91	32.73	33.25	33.33	32.99	32.82
7	32.22	32.91	32.91	32.73	33.25	33.25	32.99	32.82
8	32.14	32.91	32.91	32.73	33.25	33.33	32.99	32.82
AVERAGE	32.38	32.92	32.92	32.75	33.25	33.29	33.00	32.82
BATT 1 END-	28.81	28.12	28.30	28.04	28.98	28.89	29.15	28.81
2 OF-	28.81	28.12	28.30	28.04	28.98	28.89	29.15	28.89
3 NIGHT	28.81	28.04	28.30	28.04	28.98	28.89	29.15	28.81
4 VOLTS	28.89	28.12	28.38	28.04	28.98	28.98	29.15	28.89
5	28.89	28.21	28.38	28.12	29.06	28.98	29.23	28.89
6	28.81	28.04	28.30	27.95	28.98	28.89	29.06	28.81
7	28.81	28.12	28.30	28.04	28.98	28.89	29.15	28.81
8	28.81	28.12	28.30	28.04	28.98	28.89	29.15	28.81
AVERAGE	28.84	28.11	28.32	28.04	28.99	28.92	29.15	28.84
BATT 1 (*) CHGE	13.11	13.00	13.58	13.14	13.96	13.94	13.74	14.17
2 SHARE	12.93	13.00	* 13.58	*13.14	*13.96	*13.94	*13.74	*14.17
3 (%)	11.38	11.53	11.38	11.66	11.95	12.31	11.86	11.11
4	12.39	12.13	11.95	12.02	12.28	12.28	12.03	12.14
5	12.32	12.41	11.85	12.38	11.93	11.99	11.97	12.26
6	12.80	12.82	12.35	12.84	11.79	11.45	12.34	12.08
7	12.62	12.66	12.42	12.55	12.13	12.09	12.21	12.03
8	12.45	12.45	12.10	12.25	11.98	11.98	12.09	12.04
BATT 1 LOAD	12.71	12.61	12.44	12.68	12.58	12.78	12.86	12.18
2 SHARE	12.90	13.43	13.62	13.44	13.70	13.98	14.23	13.36
3 (%)	11.43	12.11	11.91	12.04	12.23	12.24	12.13	12.13
4	12.77	12.88	13.01	12.83	13.12	13.29	13.41	13.27
5	12.54	12.29	12.42	12.41	12.60	12.54	12.64	12.59
6	12.53	12.29	12.21	12.11	11.30	10.89	10.52	11.95
7	12.80	12.27	12.41	12.41	12.50	12.32	12.28	12.44
8	12.32	12.12	11.98	12.09	11.97	11.97	11.92	12.07
BATT 1 TEMP	21.11	25.13	24.65	25.31	24.76	24.47	24.38	25.58
2 IN	18.74	22.33	21.42	21.37	20.89	20.91	20.27	21.28
3 (°C)	18.77	20.72	20.29	20.33	20.16	20.23	19.47	19.81
4	21.57	23.23	23.17	23.28	23.32	22.97	23.02	23.66
5	21.82	26.77	23.86	27.62	24.09	24.52	24.98	25.78
6	21.21	26.95	24.37	27.84	24.78	25.04	25.47	25.78
7	21.41	27.18	25.01	27.62	24.96	25.06	25.41	26.03
8	21.82	26.68	25.14	27.01	25.24	25.12	25.38	26.07
AVERAGE	20.81	24.87	23.49	25.05	23.53	23.54	23.55	24.25
S/C REG BUS PWR (W)	176.8	182.3	153.4	160.0	165.6	165.2	143.3	151.1
COMP LOAD PWR (W) (P/O S/C REG BUS PWR)	49.0	34.8	34.8	34.8	41.9	34.8	34.8	34.8
P/L REG BUS PWR (W)	16.2	36.1	13.7	16.5	8.9	8.9	8.9	8.9
C/D RATIO	1.06	1.08	1.13	1.17	1.21	1.30	1.26	1.20
TOTAL CHARGE (A-M)	309.2	353.85	290.21	*291.5	*258.3	*281.97	*248.02	*281.80
TOTAL DISCHARGE (A-M)	290.9	327.08	256.28	249.0	214.2	216.68	197.31	217.92
SOLAR ARRAY (A-M)	1044	1028	908	934	832	836	845	857
S.A. PEAK I (AMP)	15.8	15.10	13.68	13.66	12.44	12.44	12.53	12.71
SUN ANGLE (DEG)	-3.33	+5.15	-3.54	+5.81	-1.82	+1.1	+1.58	+1.24
MAX R PAD TEMP (°C)	+62.0	+71.00	+68.00	+72.0	63.20	+65.6	+64.4	+65.6
MIN R PAD TEMP (°C)	-62.0	-56.00	-59.00	-56.0	-42.79	-42.2	-41.0	-41.0
MAX L PAD TEMP (°C)	+67.9	+66.00	+60.50	+67.0	56.00	+57.2	+57.2	+59.6
MIN L PAD TEMP (°C)	-67.0	-60.00	-64.00	-60.0	-47.00	-46.3	-44.0	-14.0

* After the telemetry failure in Orbit 4396 Battery 2 charge share was taken equal to Battery 1 charge as an approximation in order to derive a charge share value for each battery.

Table 3-2. Power Subsystem Analog Telemetry (Average Value for Data Received in NBTR Playback)

Function	Description	Unit	Orbits 26	2600	5098	7650	10182	10592	11032	11456
6001	BATT 1 DISC	AMP	0.94	1.23	0.81	1.01	0.81	0.80	0.71	0.80
6002	2		0.95	1.29	*	*	*	*	*	*
6003	3		0.84	1.17	0.78	0.95	0.80	0.75	0.68	0.75
6004	4		0.93	1.23	0.86	1.02	0.86	0.84	0.74	0.84
6005	5		0.92	1.19	0.82	0.98	0.82	0.69	0.69	0.81
6006	6		0.91	1.20	0.76	0.96	0.72	0.70	0.59	0.70
6007	7		0.94	1.19	0.82	1.01	0.80	0.79	0.69	0.79
6008	8		0.91	1.19	0.77	0.97	0.78	0.76	0.65	0.76
6011	BATT 1 CHG	AMP	0.58	0.71	0.58	0.49	0.69	0.52	0.50	0.52
6012	2		0.57	0.71	*	*	*	*	*	*
6013	3		0.50	0.63	0.48	0.44	0.60	0.46	0.45	0.46
6014	4		0.54	0.66	0.51	0.45	0.60	0.46	0.44	0.46
6015	5		0.54	0.68	0.50	0.46	0.58	0.45	0.43	0.45
6016	6		0.57	0.70	0.52	0.48	0.56	0.45	0.43	0.45
6017	7		0.55	0.70	0.53	0.47	0.60	0.46	0.44	0.46
6018	8		0.55	0.69	0.52	0.46	0.58	0.46	0.44	0.45
6021	BATT 1 VOLT	VDC	30.87	30.74	31.24	31.08	-31.64	-31.55	-31.32	-31.55
6022	2		30.87	30.74	31.25	31.08	-31.66	-31.55	-31.32	-31.55
6023	3		30.87	30.74	31.25	31.08	-31.66	-31.55	-31.32	-31.55
6024	4		30.90	30.77	31.28	31.11	-31.70	-31.59	-31.36	-31.59
6025	5		30.95	30.82	31.33	31.17	-31.75	-31.64	-31.41	-31.64
6026	6		30.86	30.72	31.24	31.07	-31.65	-31.54	-31.31	-31.54
6027	7		30.89	30.76	31.27	31.10	-31.68	-31.58	-31.34	-31.58
6028	8		30.89	30.75	31.27	31.10	-31.69	-31.58	-31.34	-31.58
6031	BATT 1 TEMP	DGC	21.17	25.19	24.48	25.38	26.09	24.33	24.71	24.33
6032	2		18.80	22.44	21.29	21.51	22.81	20.43	21.56	20.43
6033	3		18.76	20.80	20.17	20.36	21.26	20.01	20.23	20.01
6034	4		21.57	23.20	23.04	23.30	23.83	23.12	22.82	23.12
6035	5		21.84	26.86	23.77	27.68	24.78	24.72	24.98	24.72
6036	6		21.24	26.99	24.27	27.95	25.78	25.08	25.79	25.08
6037	7		21.43	27.20	24.88	27.74	26.09	25.06	25.73	25.06
6038	8		21.86	26.75	25.02	27.10	26.21	25.15	25.59	25.15
6040	RT PAD TEMP	DGC	25.82	27.98	27.22	33.79	27.16	29.54	29.85	29.54
6041	R PAD V N	VDC	33.40	33.01	33.85	33.00	34.36	34.11	33.69	34.11
6042	R PAD V N	VDC	33.29	32.43	33.50	32.05	33.60	33.38	32.69	33.38
6044	LT PAD TEMP	DGC	14.14	18.56	16.61	24.89	19.11	21.43	21.83	21.43
6045	L PAD V F	DVC	33.69	33.71	34.16	33.84	34.67	34.55	34.18	34.55
6046	L PAD V G	DVC	33.68	33.73	34.19	33.89	34.72	34.61	34.24	34.61
6050	S/C UR BUS V	VDC	31.24	31.03	31.68	31.50	-32.06	-31.99	-31.69	-31.99
6051	S/C RG BUS V	VDC	24.54	24.54	24.55	24.55	-24.55	-24.55	-24.54	-24.55
6052	AUX REG A V	VDC	23.41	23.46	23.48	23.47	-23.47	-23.49	-23.48	-23.49
6053	AUX REG B V	VDC	23.50	23.50	23.50	23.50	-23.50	-23.50	-23.50	-23.50
6054	SOLAR I	AMP	14.87	13.97	12.69	12.61	11.60	11.65	11.75	11.65
6055	S/C RG BUS I	AMP	7.11	7.45	6.27	6.54	6.80	5.91	6.52	5.91
6056	S/C RG BUS I	AMP	7.11	7.46	6.27	6.53	6.79	5.91	6.52	5.91
6058	PC MOD T 1	DGC	21.82	23.53	22.23	22.65	23.22	21.75	22.14	21.75
6059	PC MOD T 2	DGC	21.68	23.08	22.53	22.72	23.00	21.95	22.33	21.95
6070	P/L RG BUS V	VDC	24.66	24.67	24.68	24.68	-24.68	-24.68	-24.67	-24.68
6071	P/L UR BUS V	VDC	31.08	30.88	31.53	31.55	-31.92	-31.84	-31.53	-31.84
6072	P/L RG BUS I	AMP	0.57	1.47	0.56	0.67	0.36	0.36	0.36	0.36
6073	P AUX A V	VDC	23.51	23.53	23.51	23.51	-23.50	-23.50	-23.50	-23.50
6074	P AUX B V	VDC	23.51	23.53	23.51	23.51	-23.50	-23.50	-23.50	-23.50
6075	PR MOD T 1	DGC	21.50	24.40	23.13	23.36	23.62	22.08	23.15	22.08
6076	PR MOD T 2	DGC	20.34	22.31	21.45	21.62	21.84	20.58	21.41	20.58
6079	FUSE BLOW V	VDC	24.56	**	24.57	24.58	-24.60	-24.61	-24.59	-24.61
6080	SHUNT 1 I	AMP	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6081	2		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6082	3		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6083	4		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6084	5		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6085	6		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6086	7		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6087	8		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6100	P/L RG BUS I	AMP	0.58	1.47	0.56	0.67	0.36	0.36	0.36	0.36
TOTAL NO.	MAJOR FRAMES	FRM	764	425	389	387	384.	384.	384.	387.

* Function 6002, 6012; missing data resulted from disabled telemetry resulting from IC chip failure which affected charge current directly and discharge current indirectly via the power computer program.

** Function 6079; missing data resulted from logic error in master information file used in computer processing.

SECTION 4

ATTITUDE CONTROL SUBSYSTEMS

SECTION 4

ATTITUDE CONTROL SUBSYSTEM (ACS)

Performance of the Attitude Control System has been excellent throughout launch and orbital operation to approximately Orbit 11120. In Orbit 11120 the Pitch Flywheel Motor Driver duty cycle began increasing and in subsequent orbits the duty cycle rose to greater than 50%. Following a sun transient in orbit 11125 the pitch flywheel suddenly stopped. The spacecraft lost normal attitude and the spacecraft was put into powered down mode. In Orbit 11130 after several pneumatic firings the pitch wheel restarted. Normal attitude was again achieved and the motor driver duty cycle declined over several orbits to normal. The Attitude Control System continued normal operation to the end of this report period.

Pressure/temperature ratios have all been satisfactory. The forward scanner pressure decreased from 3.50 psia to 3.33 psia and is following the leak pattern described in the last report with no cause for alarm.

All pneumatic gating functions performed well with no evidence of propellant leaks. The gating history is shown in Figure 4-1. During the pitch wheel anomaly several pneumatic firings were executed and the useable impulse declined from 420.35 lb-sec at the beginning of this report period to approximately 35 lb-sec at the end of the report period. This also included pneumatic gating required to control three orbit adjust firings of the +X thruster. To reduce use of pneumatic gas in unloading momentum from the pitch and roll axes (and thereby reduce flywheel speed) the pitch flywheel speed is controlled to a range of +20 to -100 RPM using pitch position bias and gravity gradient torque resulting from the off normal pitch attitude. Roll unloading is similarly controlled by use of Differential Tachometer High Gain Mode which offsets roll approximately 5° thereby allowing gravity gradient torque to hold flywheel speeds down. Just prior to payload operation the spacecraft is returned to normal attitude where it remains for approximately six orbits of payload operation. Pitch position bias and Differential Tachometer High Gain are then re-established until the next payload operation eight orbits later. Gating was reduced from 10 to 2 gates per day.

The Rate Measuring Package No. 2 performed well but gradually showed increasing variations in operating current. Therefore as a precaution, Rate Measuring Package No. 1 was turned on and switched into the circuits on Orbit 11257. Subsequently, RMP2 was turned off and is available for use in the event of a RMP 1 failure. The Solar Array Drives performed well during this period. During this anomaly sun track was lost due to the spacecraft attitude. However, operation was normal and as anticipated during all phases until return to sun track.

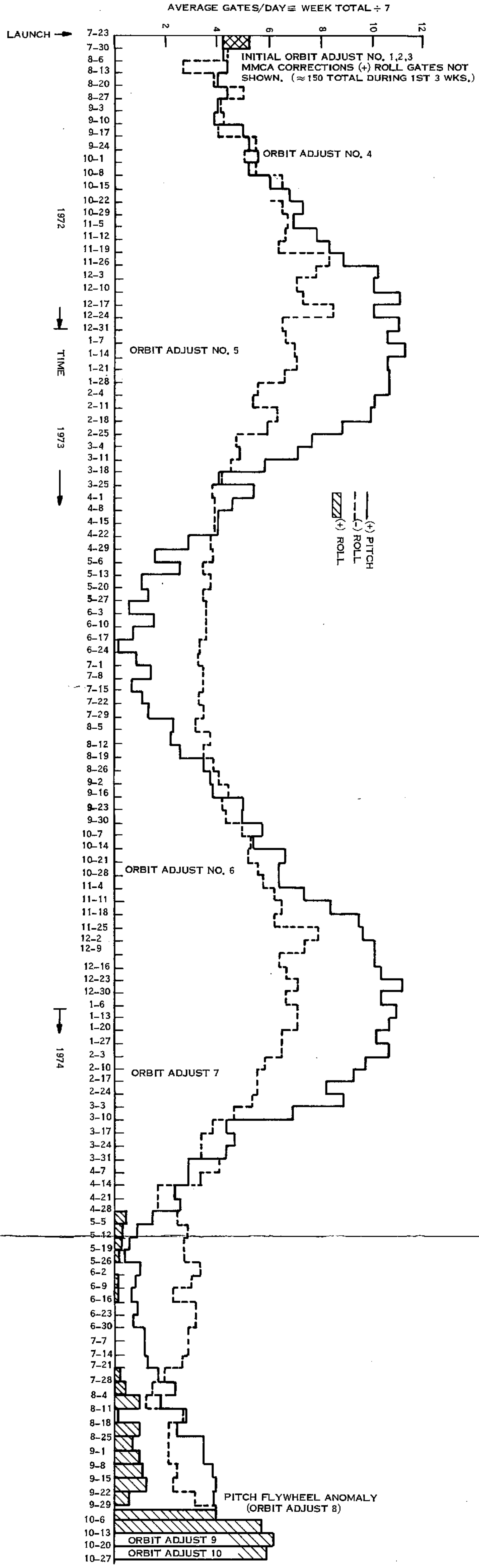

Figure 4-1. ERTS-1 Gating Frequency vs. Time

Table 4-1 is a summary of telemetry in the Attitude Control Subsystem.

Table 4-1. ACS Temperature and Pressure Telemetry Summary

Function	Units	Orbit							
		31	2600	5099	7650	10182	10592	11032	11456
1084 RMP 1 Gyro Temperature	DGC	44.5	24.28	23.06	25.21	21.22	21.81	22.27	71.69
1094 RMP 2 Gyro Temperature	DGC	74.3	75.07	75.10	75.42	43.45	43.96	44.50	26.03
1222 SAD RT MTR HSING Temp	DGC	21.1	23.07	22.00	24.29	20.55	20.88	21.28	26.03
1242 SAD LT MTR HSING Temp	DGC	27.0	32.27	30.38	33.44	28.18	28.78	29.46	31.54
1223 SAD RT MTR WNDNG Temp	DGC	25.3	27.39	26.54	28.26	24.63	24.81	25.38	29.34
1243 SAD LT MTR WNDNG Temp	DGC	28.7	34.99	32.92	35.87	30.32	30.90	31.75	34.02
1228 SAD RT HSG Pressure	PSI	7.6	7.53	7.35	7.28	7.12	7.06	7.06	7.12
1248 SAD LT HSG Pressure	PSI	7.0	7.04	6.86	6.76	6.47	6.47	6.47	6.41
1007 FWD Scanner MTR Temp	DGC	19.8	21.35	19.88	22.26	18.46	19.32	19.52	21.67
1016 Rear Scanner MTR Temp	DGC	20.5	21.25	19.83	21.79	17.86	18.28	18.77	21.48
1003 FWD Scanner Pressure	PSI	4.6	4.52	4.02	3.84	3.50	3.35	3.35	3.33
1012 Rear Scanner Pressure	PSI	7.8	8.05	7.87	7.87	7.44	7.42	7.42	7.42
1212 Gas Tank Pressure	PSI	1988.0	1849.00	1702.34	1598.59	1454.19	1455.44	1437.44	297.35
1210 Gas Tank Temperature	DGC	22.6	26.07	24.30	27.16	22.56	23.22	23.55	26.52
1213 Manifold Pressure	PSI	56.7	57.16	57.44	57.81	58.73	58.38	58.57	61.06
1211 Manifold Temperature	DGC	21.9	25.51	23.62	26.61	21.77	22.41	23.02	26.08
1059 CLB Power Supply Card Temp	DGC	37.1	42.22	40.54	43.34	38.83	39.57	39.98	42.22
1057 CLB Power Supply Volts	TMV	2.8	2.79	2.78	2.79	2.78	2.78	2.78	2.79
1081 RMP 1 MTR Volts	VDC	OFF	OFF	OFF	OFF	OFF	OFF	OFF	-30.14
1082 RMP 1 MTR Current	Amps	OFF	OFF	OFF	OFF	OFF	OFF	OFF	.11
1080 RMP 1 Supply Volts	VDC	OFF	OFF	OFF	OFF	OFF	OFF	OFF	-23.70
1091 RMP 2 MTR Volts	VDC	-29.7	-29.63	-29.63	-29.59	-29.63	-29.63	-29.62	OFF
1092 RMP 2 MTR Cuvvent	Amps	0.10	0.10	0.10	0.11	0.11	.11	.11	OFF
1090 RMP 2 Supply Volts	VDC	-23.4	-23.38	-23.41	-23.38	-23.50	-23.48	-23.47	OFF
1220 SAD RT MTR WNDNG Volts	VDC	-4.8	-4.32	-4.25	-4.18	-3.89	-3.68	-3.79	-3.82
1240 SAD LT MTR WNDNG Volts	VDC	-4.8	-4.12	-4.09	-3.95	-3.36	-3.27	-3.31	-3.31
1227 SAD RT -15 VDC Conv.	VDC	14.9	14.90	14.88	14.88	14.89	14.89	14.89	14.88
1247 SAD LT -15 VDC Conv.	VDC	15.2	15.15	15.13	15.13	15.14	15.14	15.13	15.13
1056 CLB ± 6 VDC	TMV	2.4	2.35	2.35	2.35	2.35	2.35	2.35	2.35
1055 CLB ± 10 VDC TMV	TMV	2.75	2.75	2.75	2.75	2.74	2.74	2.74	2.75
1260 ACS Baseplate 1	DGC	25.4	29.71	27.93	31.01	25.36	26.01	26.64	28.57
1261 ACS Baseplate 2	DGC	22.9	26.42	24.73	27.76	23.00	23.74	24.22	27.20
1262 ACS Baseplate 3	DGC	23.4	25.09	23.69	26.24	21.97	22.51	23.04	27.89
1263 THO1 STS	DGC	-6.8	0.59	-0.97	3.97	-3.41	-1.80	-.28	3.83
1264 THO2 STS	DGC	-14.6	-8.81	-9.42	-3.85	-8.27	-7.10	-5.81	-3.43
1265 THO3 STS	DGC	-3.1	9.32	9.31	15.52	7.58	11.97	11.65	14.45
1266 THO4 STS	DGC	-13.9	-2.55	2.85	4.46	-1.85	2.54	.75	4.43
1267 THO5 STS	DGC	-8.9	-0.97	-1.16	6.73	-5.17	-3.08	-.40	5.77
1224 SAD R FSST	DGC	39.5	52.87	60.21	61.90	63.25	63.00	63.90	65.74
1244 SAD L FSST	DGC	27.1	45.64	51.11	56.46	53.21	54.02	54.89	56.25

SECTION 5

COMMAND/CLOCK SUBSYSTEM

SECTION 5

COMMAND/CLOCK SUBSYSTEM (CMD)

Command processing for both real time and stored commands for ERTS-1 has been normal during this period.

Commanding difficulties which have been experienced have been isolated to ground transmission problems.

Missed real time commands, attributed to the logic race in the command clock design, are occasionally noted.

On rare occasions stored commands are blocked by a real time sequence being transmitted during the stored command time tag. Usually the commands interlace as expected; however, several instances have been noted when the stored command did not execute. In Appendix C, a PIR describes two executions without commands.

The spacecraft time base, provided by the time code generator has been well within specifications. The clock has been reset four times in orbit: at the beginning of 1973 during orbits 2249 and 2274; in August 1973 during orbit 5578; and the beginning of 1974 during Orbit 7339 (Figure 5-1). The drift rate of the spacecraft clock is shown in Figure 5-2. The negative drift rate has decreased 33% since launch.

The changes in the subsystem are not sufficient to consider switching to alternate units from the original launch configuration.

Table 5-1 gives typical telemetry values.

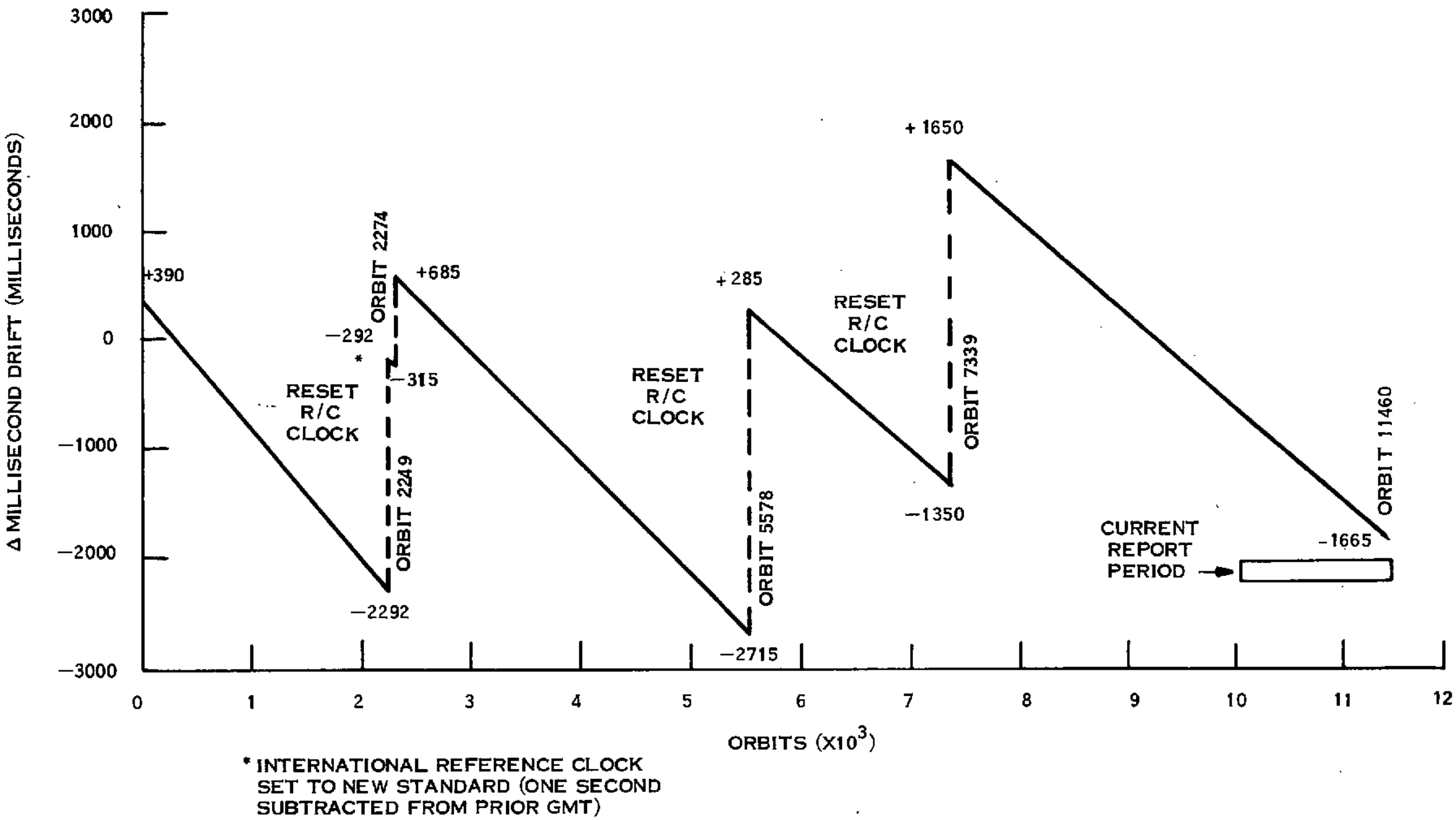

Figure 5-1. Spacecraft Clock Drift Rate

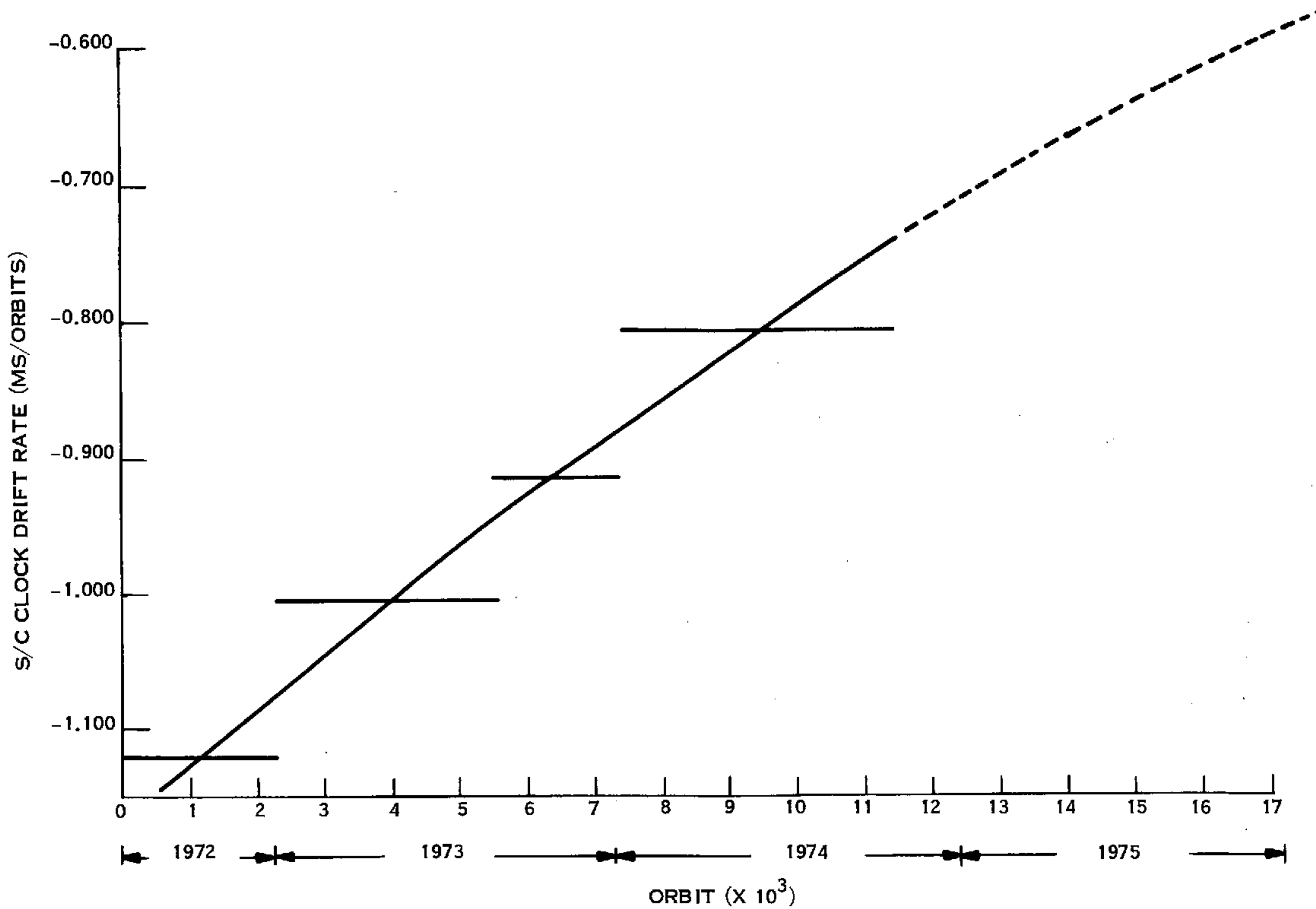

Figure 5-2. Spacecraft Clock Drift Rate

Table 5-1. Command Clock Telemetry Summary

Function No.	Name	Mode	Units	Orbit 35	2600	5099	7650	10182	10592	11032	11456
8005	Pri. Power Supply Temp	-	°C	37.31	38.91	39.37	39.24	39.50	39.05	38.96	39.44
8006	Red. Power Supply Temp	-	°C	35.73	37.56	38.08	38.09	38.38	38.11	37.90	38.39
8007	Pri. Osc. Temp	-	°C	31.14	31.92	31.98	32.05	32.11	31.89	31.74	32.08
8008	Red. Osc. Temp	-	°C	30.47	31.31	31.39	31.41	31.42	31.25	31.05	31.41
8009	Pri. Osc. Output	-	TMV	0.95	0.96	0.96	0.97	0.97	0.96	0.96	0.97
8010	Red. Osc. Output	-	TMV	**	**	**	**	**	**	**	**
8011	100 kHz	Pri. - Red.	TMV	3.11	3.11	3.10	3.11	3.11	3.12	3.11	3.10
8012	10 kHz	Pri. - Red.	TMV	3.10	3.08	3.07	3.08	3.08	3.08	3.08	3.07
8013	2.5 kHz	Pri. - Red.	TMV	2.95	2.95	2.95	2.95	2.95	2.95	2.95	2.95
8014	400 Hz	Pri. - Red.	TMV	4.40	4.40	4.40	4.40	4.40	4.40	4.40	4.40
8015	Pri. +4V Power Supply	Pri. Clk ON	VDC	4.10	4.10	4.10	4.10	4.10	4.10	4.10	4.10
8016	Red. +4V Power Supply	Red. Clk ON	VDC	3.95	3.95	3.95	3.95	3.95	3.95	3.95	3.95
8017	Pri. +6V Power Supply	Pri. Clk ON	VDC	6.06	6.08	6.07	6.07	6.07	6.07	6.07	6.07
8018	Red. +6V Power Supply	Red. Clk ON	VDC	6.00	5.95	5.94	5.94	5.94	5.93	5.94	5.93
8019	Pri. -6V Power Supply	Pri. Clk ON	VDC	-6.02	-6.03	-6.02	-6.02	-6.03	-6.02	-6.03	-6.02
8020	Red. -6V Power Supply	Red. Clk ON	VDC	-5.99	-6.00	-6.00	-6.00	-6.00	-5.99	-6.00	-5.99
8021	Pri. -23V Power Supply	Pri. Clk ON	VDC	-22.88	-22.90	-22.89	-22.89	-22.89	-22.88	-22.89	-22.88
8022	Red. -23V Power Supply	Red. Clk ON	VDC	-22.98	-23.02	-23.00	-23.00	-23.01	-22.99	-23.00	-23.00
8023	Pri. -29V Power Supply	Pri. Clk ON	VDC	-29.13	-29.14	-29.16	-29.15	-29.15	-29.15	-29.14	-29.15
8024	Red. -29V Power Supply	Red. Clk ON	VDC	-29.07	-29.21	-29.21	-29.21	-29.21	-29.21	-29.21	-29.22
8101	CIU A -12V	CIA A ON	VDC	-12.33	-12.33	-12.33	-12.33	-12.34	-12.34	-12.34	-12.35
8102	CIU B -12V	CIU B ON	VDC	-12.26	-12.26	-12.26	-12.26	-12.23	-12.22	-12.21	-12.23
8103	CIU A -5V	CIU A ON	VDC	-5.32	-5.34	-5.34	-5.34	-5.34	-5.34	-5.34	-5.34
8104	CIU B -5V	CIU B ON	VDC	-5.31	-5.31	-5.31	-5.31	-5.31	-5.31	-5.31	-5.31
8105	CIU A Temp	CIU A ON	°C	24.47	24.85	24.77	25.04	25.04	24.77	24.73	25.16
8106	CIU B Temp	CIU B ON	°C	24.96	25.42	25.31	25.54	25.45	25.18	25.11	25.56
8201	Receiver RF-A Temp	-	°C	**	**	**	**	28.67	28.14	28.17	28.45
8202	Receiver RF-B Temp	-	°C	27.98	28.46	28.22	28.39	**	**	**	**
8203	D MOD A Temp	-	°C	25.41	25.82	25.73	25.86	37.98	37.58	37.55	37.82
8204	D MOD B Temp	-	°C	35.03	35.59	35.61	35.71	26.12	25.60	25.64	25.87
8205	Receiver A AGC	Receiver A ON	DBM	**	**	**	**	-96.77	-92.49	-95.37	-95.39
8206	Receiver B AGC	Receiver B ON	DBM	-94.74	-89.91	-84.67	-89.05	**	**	**	**
8207	Amp. A Output	Receiver A ON	TMV	**	**	**	**	2.31	2.57	2.31	2.48
8208	Amp. B Output	Receiver B ON	TMV	2.81	2.81	3.22	2.92	**	**	**	**
8209	Freq. Shift Key A OUT	Receiver A ON	TMV	**	**	**	**	1.10	1.10	1.10	1.10
8210	Freq. Shift Key B OUT	Receiver B ON	TMV	1.10	1.10	1.11	1.11	**	**	**	**
8211	Amp. A Output	Receiver A ON	TMV	**	**	**	**	1.10	1.10	1.10	1.10
8212	Amp. B Output	Receiver B ON	TMV	1.13	1.14	1.13	1.13	**	**	**	**
8215	D MOD A -15V	Receiver A ON	TMV	**	**	**	**	5.00	5.00	5.00	5.00
8216	D MOD B -15V	Receiver B ON	TMV	5.00	5.00	5.00	5.00	**	**	**	**
8217	Regulator A -10V	Receiver A ON	TMV	**	**	**	**	5.40	5.40	5.40	5.40
8218	Regulator B -10V	Receiver B ON	TMV	5.50	5.50	5.50	5.50	**	**	**	**

**Units not in use

SECTION 6

TELEMETRY SUBSYSTEM

SECTION 6

TELEMETRY SUBSYSTEM

The Telemetry Subsystem was launched in the ON mode and has been operating continuously since, providing data from the spacecraft to either ground stations or the narrow band recorders, or to both. Typical telemetry values are given in Table 6-1. Only memory Section 0. 0 has been used in the telemetry matrix. Total performance has been normal except for one integrated circuit chip failure in Orbit 4396, containing four functions (6012, 1011, 12238, 7010).

Table 6-1. TLM Telemetry Summary

Function No.	Function Name	Orbit								
		Unit	35	2600	5099	7650	10182	10592	11032	11456
9001	Memory Sequencer A Converter	VDC	6.35	6.34	6.33	6.33	6.33	6.33	6.33	6.33
9002	Memory Sequencer B Converter	VDC	**	**	**	**	**	**	**	**
9003	Memory Sequencer Temp.	°C	19.59	21.47	21.06	22.67	21.76	21.30	21.39	21.79
9004	Formatter A Converter	VDC	5.99	5.99	5.99	5.99	5.99	5.99	5.99	5.99
9005	Formatter B Converter	VDC	**	**	**	**	**	**	**	**
9006	Dig. Mux A Converter	VDC	10.01	10.07	10.04	10.07	10.07	10.07	10.07	10.07
9007	Dig. Mux B Converter	VDC	**	**	**	**	**	**	**	**
9008	Formatter/Dig. Mux Temp.	°C	22.50	27.34	24.89	27.97	24.96	25.0	25.65	25.97
9009	Analog Mux A Converter	VDC	26.01	26.18	21.18	26.18	26.20	26.20	26.22	26.20
9010	Analog Mux B Converter	VDC	**	**	**	**	**	**	**	**
9011	A/D Converter A Voltage	VDC	10.00	10.07	10.07	10.07	10.07	10.07	10.07	10.07
9012	A/D Converter B Voltage	VDC	**	**	**	**	**	**	**	**
9013	Analog Mux A/D Converter	°C	25.00	27.50	26.83	29.43	27.25	27.49	27.27	27.50
9014	Preregulator A Voltage	VDC	19.93	19.99	19.95	19.19	19.28	19.94	19.98	19.98
9015	Preregulator B Voltage	VDC	**	**	**	**	**	**	**	**
9016	Reprogrammer Temp.	°C	22.00	25.00	22.50	26.05	24.13	22.53	24.45	24.34
9017	Memory A Converter	VDC	6.00	6.00	5.99	6.00	6.00	6.00	6.00	6.00
9018	Memory A Temp.	°C	17.51	19.06	17.50	19.00	18.98	17.50	17.57	17.50
9019	Memory B Converter	VDC	**	**	**	**	**	**	**	**
9020	Memory B Temp.	°C	17.68	19.29	17.63	19.82	19.09	17.51	18.39	18.58
9100	Reflected Power (Xmtr A)	dBm	11.95	12.75	12.32	13.11	12.32	12.38	12.37	12.43
9101	Xmtr A -20 VDC	VDC	-19.75	-19.78	-19.76	-19.78	-19.76	-19.75	-19.76	-19.75
9102	Xmtr B -20 VDC	VDC	**	**	**	**	**	**	**	**
9103	Xmtr A Temp.	°C	20.95	24.06	21.14	25.24	21.55	22.01	22.25	22.56
9104	Xmtr B Temp.	°C	21.69	25.02	21.95	26.36	22.31	22.76	23.04	23.36
9105	Xmtr A Power Output	dBm	25.12	25.36	25.35	25.38	25.24	25.24	25.24	25.24
9106	Xmtr B Power Output	dBm	**	**	**	**	**	**	**	**

** Units not used since prelaunch

SECTION 7

ORBIT ADJUST SUBSYSTEM (OAS)

SECTION 7

ORBIT ADJUST SUBSYSTEM (OAS)

The Orbit Adjust Subsystem has been fired nine times, seven times using the -X thruster and two times using the +X thruster. Three -X firings were for initial orbit correction and six -X for orbit maintenance. A 8.0 second burn was executed in orbit 11464 using the +X thruster for the first time. All functions were normal with the expected ephemeris changes being achieved. Pressure/temperature parameters continue to be normal. There is 64.87 pounds of hydrazine fuel remaining from an initial prelaunch load of 67.00 pounds. Table 7-1 is a summary of ERTS-1 orbit parameters before and after each orbit adjust. Note that the pneumatic gas expended during the pitch flywheel anomaly resulted in an orbit adjustment. Figure 2-2 shows spacecraft ground track drift from standard orbit tracks and the effects of orbit adjustment. Orbit Adjustments 9 and 10 counteracted the drift rate initiated by the pneumatic gas firing. Table 7-2 is a summary of OAS performance to date and Table 7-3 gives average telemetry values for the off quiescent state.

Table 7-1. ERTS1-Brouwer Mean Elements

		Pitch Flywheel Stoppage 29 Sept 74		Orbit Adjust No. 9, 16 Oct. 74		Orbit Adjust No. 10, 23 Oct. 74	
		Pre Stoppage	Post Stoppage	Pre Burn	Post Burn	Pre Burn	Post Burn
Apogee	KM	912.107	912.410	916.900	916.872	918.683	918.657
Perigee	KM	902.795	902.834	898.343	898.241	896.423	896.316
Inclination	Deg	99.007	99.007	99.004	99.005	99.004	99.004
Semimajor Axis	KM	7285.616	7285.787	7285.787	7285.722	7285.718	7285.652
Eccentricity	--	0.000639	0.000657	0.00127	0.00128	0.00153	0.00153
Anomalistic Period	Min	--	--	103.151	103.150	103.150	103.148
Nodal Period	Min	103.263	103.267	103.267	103.265	103.265	103.264
Argument of Perigee	Deg	164.840	169.621	157.464	157.346	150.542	150.750
Right Ascension	Deg	331.427	331.427	347.953	347.952	354.744	354.743
Mean Anomaly	Deg	15.132	10.347	22.432	22.549	29.318	29.110

Table 7-2. ERTS-1 Orbit Adjust Summary

Orbit	Orbit Adjust No.	Ignition Epoch	Burn Duration (Seconds)	+ $\Delta \bar{a}$ (Meters)	Engine Performance Efficiency	Fuel Used (Lbs)	Tank Pressure (PSIA)	Tank Temperature (°F)	Axis Thruster
38	1.	26 Jul 72 11:25:0.0	4.8	12	60%		540	75	-X
44	2.	26 Jul 72 21:44:46	250.0	1975	103.4%	2.15	U[2]	U[2]	-X
59	3.	27 Jul 72 23:34:45	318.0	2391	101.5%		516	73.9	-X
938	4.	29 Sep 72 00:30:00	11.8	98	110%	.039	U[2]	U[2]	-X
2416	5.	13 Jan 73 00:21:30	20.4	154	106%	.071	489.4	75.4	-X
6390	6.	25 Oct 73 00:04:10.8	14.8	110	100%	.048	486.8	73.9	-X
7826	7.	4 Feb 74 23:27:10.4	14.8	112	101.8%	.048	490.59	75.4	-X
11125	8.	29 Sep 74 1200-2400	Pneumatics	171	N/A	ACS	N/A	N/A	ACS[3]
11367	9.	16 Oct 74 22:42:10.8	8.0	-65	106%	.026	490.59	74.0	+X
11464	10.	23 Oct 74	8.4	-66	102%	.027	490.59	73.9	+X

[1] Initial Fuel Capacity - 67#

[2] Unavailable

[3] Stuck Pitch Momentum Wheel

Table 7-3. OAS Telemetry Values

Function No.	Name	Units	Orbit 35	2600	5099	7650	10182	10592	11032	11456
2001	Prop. Tank Temp.	°C	22.03	23.91	22.86	24.53	23.28	22.78	22.49	23.28
2003	Thrust Chamber No. 1 (-x) Temp. (1)	°C	29.57	28.50	29.93	27.77	30.55	29.25	28.88	30.12
2004	Thrust Chamber No. 2 (+x) Temp. (1)	°C	38.76	33.74	40.28	39.27	38.91	37.79	38.07	39.30
2005	Thrust Chamber No. 3 (-y) Temp. (1)	°C	34.55	46.23	34.41	47.52	36.09	38.64	40.07	41.31
2006	Line Pressure	Psia	539.29	486.87	486.74	491.10	490.61	486.87	486.92	490.49

(1) Wide spread of temperature is due to nozzle locations and satellite day/night transitions relative to data averaged. Typical orbital range is from 19 to 59 DGC.

SECTION 8

MAGNETIC MOMENT COMPENSATING ASSEMBLY (MMCA)

SECTION 8

MAGNETIC MOMENT COMPENSATING ASSEMBLY (MMCA)

The spacecraft was corrected for unbalanced magnetic moments in Orbits 73, 85, 110, and 220 as reported in early reports. Adjustments were made in the pitch positive dipole.

In Orbit 11181 the positive Yaw coil received capacitor charge and dump of 43 seconds in order to reduce the amplitude of the Pitch flywheel orbit frequency oscillation. Data showed that the opposite polarity was required as the oscillation increased. In Orbit 11186, the positive yaw coil received capacitor charge and dump of 240 seconds, followed by 58 seconds of charge and dump on the negative Yaw coil, followed by another 58 seconds of charge and dump on the negative Yaw coil. This resulted in a negative yaw dipole which reduced the amplitude of the Pitch orbit frequency oscillation to a small value.

In Orbit 11185 the positive Roll received capacitor charge and dump of 240 seconds, followed five minutes later by 42 seconds of charge and dump into the negative Roll coil. This was a five minute test to determine if a positive Roll dipole at the poles could unload the Pitch flywheel. Results were favorable. The Roll dipole was returned to the same magnitude and polarity present before the test.

The current dipole values are:

Pitch +2950 Pole-Cm

Roll zero Pole-Cm

Yaw -3000 Pole-Cm

Telemetry measurement shown in Table 8-1 shows that the dipoles are holding steady without change.

Table 8-1. MMCA Telemetry Summary

Number	Name	Units	Orbits							
			35	2600	5099	7650	10182	10592	11032	11456
4001	A1 Board Temp	°C	19.77	19.37	19.03	19.12	19.11	18.42	18.51	18.68
4002	A2 Board Temp	°C	23.58	23.36	23.05	23.15	23.13	22.51	22.60	22.72
4003	Hall Current	TMV	3.48	3.49	3.48	3.48	3.48	3.48	3.48	3.48
4004	Yaw Flux Density	TMV	3.11	3.10	3.11	3.13	3.15	3.15	3.15	3.99
4005	Pitch Flux Density	TMV	3.13	2.50	2.51	2.52	2.52	2.51	2.52	2.52
4006	Roll Flux Density	TMV	3.19	3.20	3.19	3.19	3.20	3.20	3.20	3.27

SECTION 9

UNIFIED S-BAND/PREMODULATION PROCESSOR

SECTION 9

UNIFIED S-BAND/PREMODULATION PROCESSOR

The Unified S-Band (USB) Subsystem has operated satisfactorily since launch, despite repeated and large drops in transmitter power output of the A-section. The B-section of the USB dual installation was substituted during Orbit 10068 restoring full 1.5 watts output from the 0.14 watts to which the A-section transmitter had declined, as shown in Figure 9-1.

The USB-A Receiver was ON continuously from launch to mid Orbit 10068, for a total of 17,327 hours. The A-section transmitter was ON only during station passes from launch to mid Orbit 10068 for a total of 2253 hours. It was commanded ON for transmission of real-time telemetry, playback of stored telemetry, ranging data for computation of ERTS-A ephemeres and for relay of DCS data.

The B-section receiver has been on continuously since mid Orbit 10068 for a total of 2398 hours. The B-section transmitter has been ON for a total of 312 hours.

Table 9-1 lists telemetry values, all normal and typical for this reporting period.

Figure 9-2 shows AGC readings at Goldstone for a constant reference orbit in each cycle since launch. All data are taken, therefore, at the same range elevation and azimuth. The AGC difference (8 dB) between the curves is caused by the dual effects of doubling the distance (6 dB) and the USB antenna pattern. The effect of the USB transmitter-A power decline can be seen thru 38 cycles, and then the rise caused by substituting the higher powered B-transmitter (10 dB) thru cycle 42. The dashed curves for cycles 43, 44 and 45 are over 9 dB higher because of the larger dish size used by Goldstone during this period.

Table 9-1. USB/PMP Telemetry Values

Function			Telemetry Value						
			Orbit						
No.	Name	Units	35	2566	5099	10182	10592	11032	11454
11001	USB Revr. AGC	DBM	-122.78	-126.18	-131.99	-132.00	-129.81	-128.15	-126.18
11002	USB Trans. Pwr	WTS	1.60	0.62	0.29	1.55	1.54	1.55	1.52
11003	Receiver Error	KHZ	21.79	-20.87	-21.32	-21.46	-23.25	-22.26	-23.68
11004	Trans. Temp.	DGC	22.92	25.30	22.64	24.73	25.54	25.49	26.20
11005	Trans. Pressure	PSI	15.91	16.09	15.91	15.92	15.92	15.91	15.94
11007	Trans A-15VDC	VDC	-15.20	-15.20	-15.20	**	**	**	**
11009	Ranging-15 VDC	VDC	-14.76	-14.76	-14.76	-14.60	-14.58	-14.59	-14.58
11101	PMP A Volt	VDC	-15.12	-15.18	-15.18	**	**	**	**
11103	PMP A Temp.	DGC	30.44	33.70	30.23	**	26.60	26.88	27.38
11102	PMP B Volt	VDC	**	**	**	-15.12	-15.12	-15.10	-15.08
11104	PMP B Temp	DGC	**	**	**	30.76	31.64	31.76	32.42
11008	Trans B-15VDC	VDC	**	**	**	-15.20	-15.20	-15.20	-15.20

** Unit Not In Use.

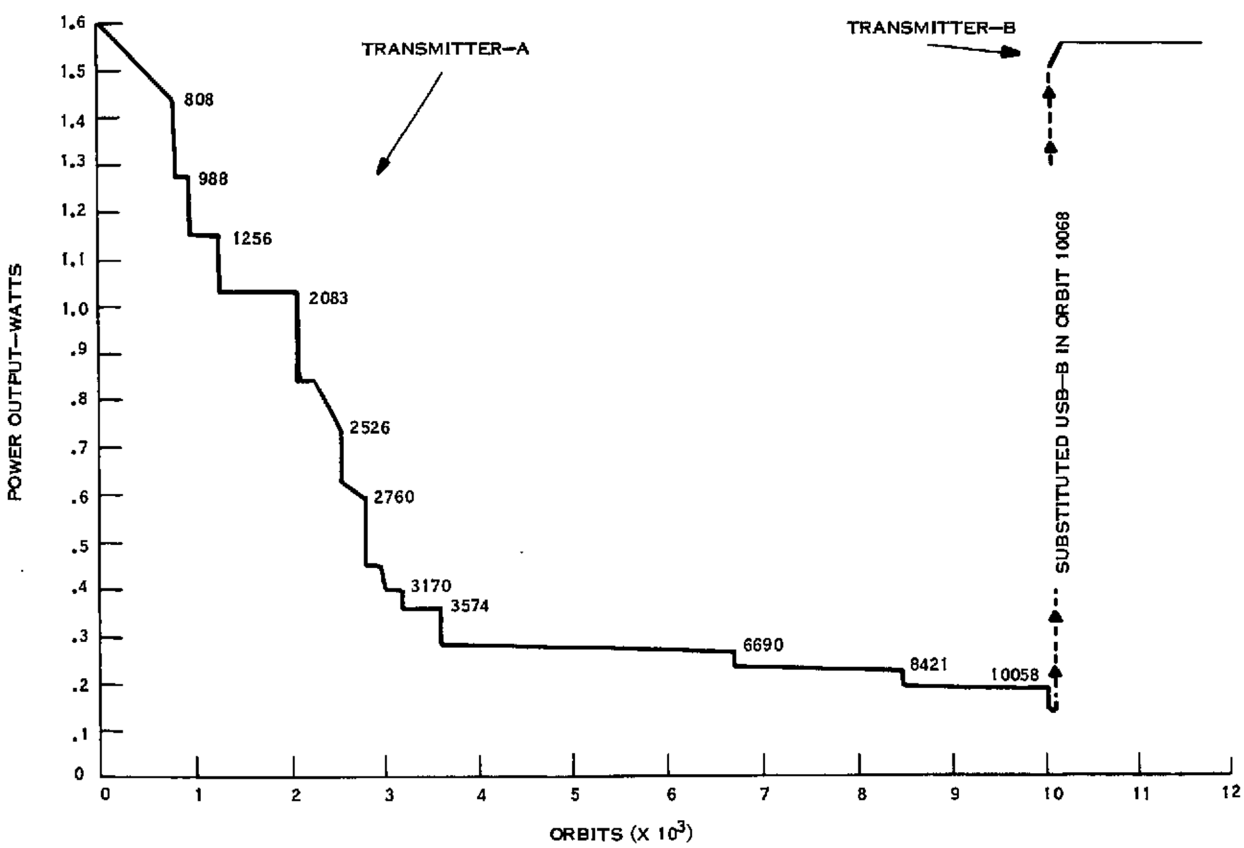

Figure 9-1. USB Power Output History

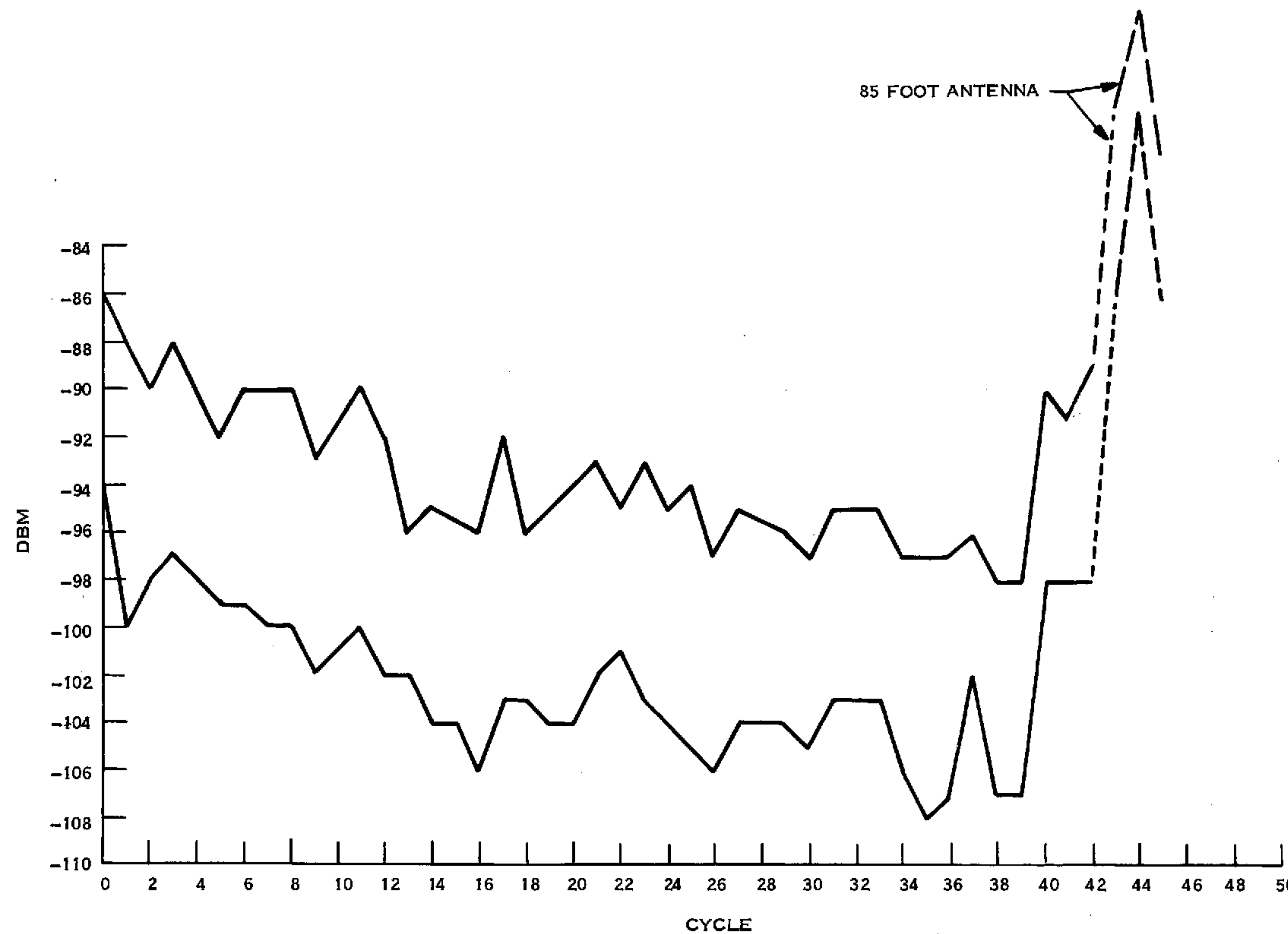

Figure 9-2. USB AGC Readings at Goldstone with 30-Foot Antenna

SECTION 10

ELECTRICAL INTERFACE SUBSYSTEM

SECTION 10

ELECTRICAL INTERFACE SUBSYSTEM

Auxiliary Processing Unit (APU) consists of Search Track Data, Time Code Data, and Back-up Timers which operated satisfactorily throughout this report period. Telemetry for the APU is shown in Table 10-1. The APU is in Normal mode. During the pitch flywheel anomaly the APU was turned off but returned to Normal mode after return to normal operation of the spacecraft.

Table 10-1. APU Telemetry Functions

Functions	Description	Unit	Orbit							
			7	2600	5098	7650	10182	10592	11032	11456
13200	APU, -24.5 VDC	VDC	-24.90	-24.90	-24.90	-24.91	-24.91	-24.90	-24.90	-24.90
13201	APU, -12 Volts	VDC	-12.08	-12.08	-12.08	-12.07	-12.07	-12.07	-12.07	-12.06
13202	APU Temp.	DGC	25.49	28.50	26.95	29.21	27.15	27.43	27.55	28.13

The Power Switching Module (PSM) contains the switching relays for power to Orbit Adjust, MSS, WBVTR No. 1 and No. 2, RBV and PRM. The MSS power circuit have been operated on a regular basis throughout this report period. The power relay for the RBV remained in a failed closed condition since Orbit 196, but the RBV remained off by relays in the camera subsystem. The WBVTR No. 2 remained off due to the failure occurring in Orbit 148. The WBVTR No. 1 was operated intermitterly for engineering tests. All switching during this report period was normal.

The Interface Switching Module (ISM) performed all switching normally during this report period. Compensation Loads changes were exercised in this report period as reported in Table 11-2.

During the pitch flywheel anomaly all loads were switched off including the PRM (in orbit 11131), in order to conserve power. The PRM, was put back in service and spacecraft normal operation returned in orbit 11133.

SECTION 11

THERMAL SUBSYSTEM

SECTION 11

THERMAL SUBSYSTEM

The Thermal Subsystem has maintained spacecraft temperature control over a satisfactory range during this report period. Table 11-1 shows average analog telemetry values from data recorded on the NBTR. During this report period, the sun angle varied as shown in Figure 3-3 and the intensity decreased as shown in Figure 3-4 for day 205 to 296. Figure 11-1 shows a typical thermal profile for average bay temperatures of the sensory ring in this report period. The values are consistent with the limits established over two years of orbital operation.

The Compensation Load History is shown in Table 11-2. In Orbit 10410 compensation load number 3 was turned off to allow better power management via the auxiliary loads. In Orbit 11125 the spacecraft was powered down due to the pitch flywheel anomaly and all compensation loads were turned off. In Orbit 11126 compensation loads 1, 2, 4, 5 and 8 were turned on. Again in Orbit 11127 it was necessary to power down the spacecraft to a minimum load and all compensation loads were turned off. After acquisition of normal attitude and sun lock of the solar panels in Orbit 11133, compensation loads 1, 2, 4, 5, and 8 were turned on and remained on.

The thermal system of the spacecraft was tested during the period from Orbit 11127 to Orbit 11133 as all compensation loads were off and the spacecraft was powered down with all systems turned off (including Narrow Band Recorders) except for the minimum spacecraft loads. This allowed the spacecraft to reach its coolest temperature. Day duration was 72 minutes 14 seconds and night duration was 31 minutes 2 seconds. Table 11-1 shows Orbit 11133 temperature at the minimum value before rising and resumption of normal operations. All monitoring points retained reasonable temperatures compared to normal operations shown in Orbits 10592, 11032 and 11456. The temperature control shutters closed and minimized the temperature decreases as they were designed to do.

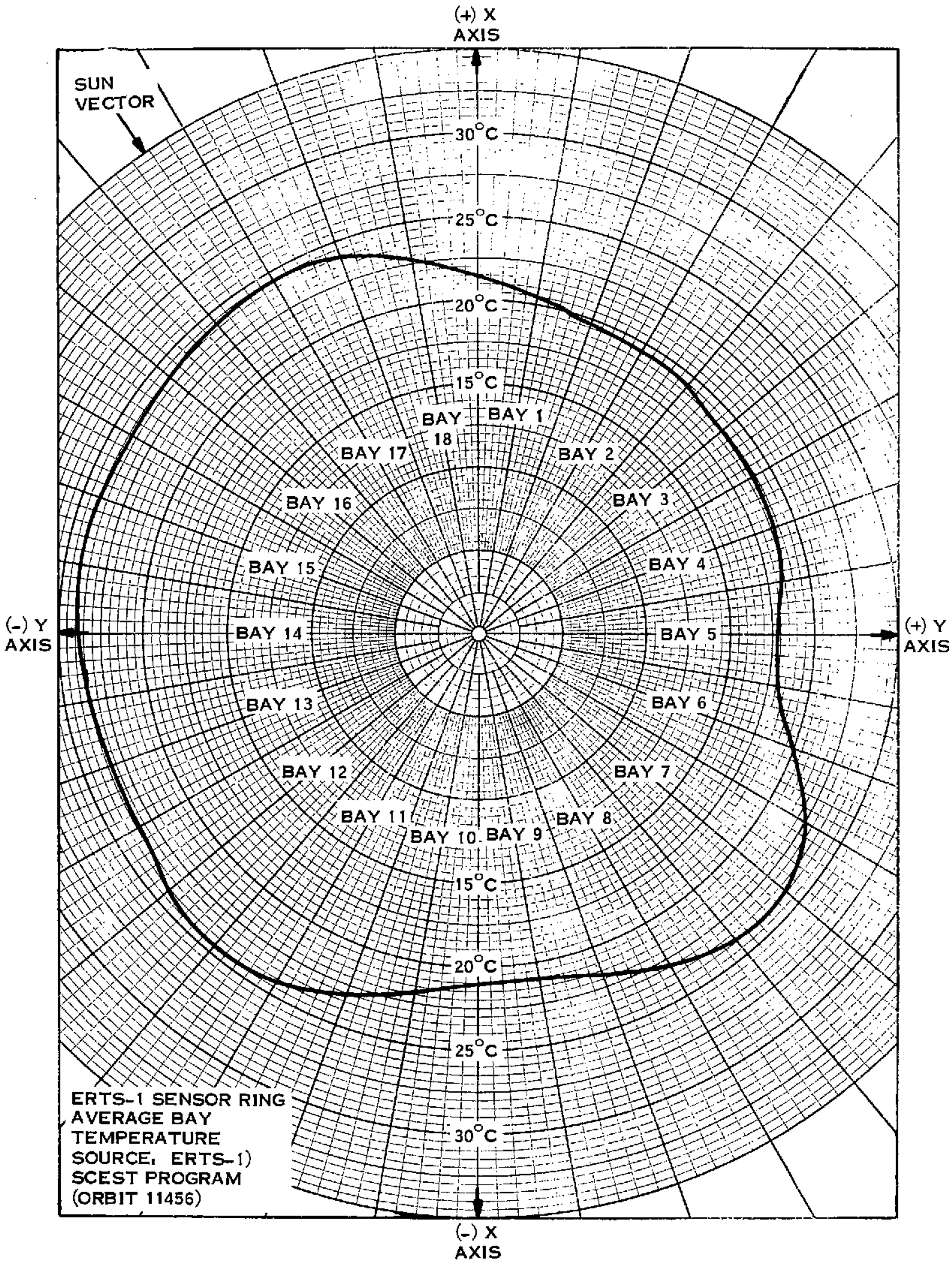

Figure 11-1. ERTS-1 Sensor Ring Thermal Profile

FOLDOUT FRAME 1

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Table 11-1. Thermal Subsystem Analog Telemetry (Average Value for Frames of Data Received in NBTR Playback)

Function		Unit	Orbits								
Function No.	Description		26	2600	5098	7650	10182	10592	11032	11133	11456
7001	THM TH01 STI	DGC	19.52	22.18	20.85	22.24	21.65	20.38	20.88	18.99	21.02
7002	THM TH02 SBO	DGC	18.60	20.55	19.95	20.38	20.60	19.31	20.00	17.78	19.78
7003	THM TH03 STI	DGC	18.48	21.79	20.16	20.83	20.87	19.03	20.12	16.95	19.49
7004	THM TH03 SBI	DGC	19.47	21.11	20.25	21.50	20.36	20.37	20.40	18.35	20.94
7005	THM TH04 STI	DGC	18.39	21.17	19.71	20.12	20.35	18.65	19.82	16.20	18.94
7006	THM TH05 SBO	DGC	17.57	19.04	18.39	18.55	18.81	17.80	18.29	15.70	17.88
7007	OA -X THRUSTER	DGC	21.95	22.38	22.95	22.55	22.90	22.44	22.30	21.13	22.82
7008	THM TH07-STO	DGC	15.95	17.09	16.61	16.72	16.90	16.10	16.35	14.48	16.14
7009	THM TH06 SBI	DGC	19.38	21.05	20.35	21.04	20.93	19.84	20.32	17.46	20.00
7010	THM TH07 STI	DGC	18.61	19.79	*	*	*	*	*	*	*
7011	THM TH08 STO	DGC	21.78	22.52	22.77	22.61	22.88	22.36	22.34	20.98	22.72
7012	THM TH09 SBI	DGC	21.81	23.10	22.87	23.32	23.08	22.74	22.66	20.16	23.18
7013	THM TH10 SBO	DGC	18.73	19.87	19.53	20.04	19.64	19.43	19.35	18.21	19.85
7014	THM TH11 STI	DGC	22.37	24.52	23.35	25.01	23.57	23.59	23.65	20.72	24.22
7015	THM TH12 SBO	DGC	22.37	25.36	23.17	25.95	23.03	23.51	23.63	22.42	24.22
7016	THM TH13 STI	DGC	20.95	24.55	22.02	25.37	22.47	22.80	23.03	21.22	23.52
7017	RBV BEAM CTR LN	DGC	21.53	23.30	22.62	23.72	22.84	22.67	22.65	19.59	23.22
7018	THM TH14 STO	DGC	20.38	24.77	21.40	26.10	21.93	22.34	22.72	20.92	23.16
7019	NBR RAD OUTBD B4	DGC	5.09	6.06	5.86	6.10	6.00	5.39	5.43	4.08	5.63
7020	THM TH15 SBI	DGC	21.14	26.21	23.24	27.39	23.99	23.76	24.41	22.06	24.60
7021	THM TH16 STI	DGC	20.73	25.44	22.90	26.30	23.68	23.06	23.82	21.40	23.90
7022	THM TH17 SBI	DGC	20.22	25.18	22.76	25.72	23.56	22.73	23.43	21.02	23.65
7023	THM TH18 SBO	DGC	21.90	25.79	24.29	26.55	25.19	24.31	24.82	21.96	25.26
7030	THM TH03 BUR	DGC	16.05	17.89	17.07	17.01	17.42	15.88	16.89	14.41	16.18
7031	THM TH06 BUR	DGC	13.59	14.49	14.17	14.15	14.28	13.57	13.72	12.11	13.71
7032	THM TH09 BUR	DGC	19.92	20.61	20.75	20.83	20.74	20.45	20.35	19.24	20.85
7033	THM TH12 BUR	DGC	21.51	24.59	22.16	25.25	22.76	23.39	23.51	23.22	24.08
7034	THM TH15 BUR	DGC	19.70	24.36	21.67	25.92	22.38	22.22	22.97	19.51	23.16
7035	THM TH18 BUR	DGC	20.11	22.45	21.36	23.10	22.02	21.21	21.59	18.86	21.88
7040	THM TH01 TCB	DGC	19.27	21.58	20.46	21.59	21.26	20.00	20.64	18.59	20.63
7041	THM TH02 TCB	DGC	17.99	20.00	19.23	19.60	19.89	18.50	19.17	17.31	18.88
7042	THM TH03 TCB	DGC	18.34	21.83	19.94	20.12	20.92	18.41	20.47	16.27	18.72
7043	THM TH04 TCB	DGC	18.95	20.71	19.94	20.03	20.26	19.11	19.86	16.12	19.28
7044	THM TH05 TCB	DGC	16.27	17.45	16.98	17.09	17.32	16.51	16.84	14.78	16.59
7045	THM TH07 TCB	DGC	18.41	19.36	19.21	19.27	19.45	18.83	18.92	17.08	19.04
7046	THM TH09 TCB	DGC	19.38	20.52	20.37	20.51	20.64	20.22	20.08	18.02	20.63
7048	THM TH11 TCB	DGC	21.98	24.32	22.94	24.92	23.18	23.37	23.48	21.12	24.03
7049	THM TH12 TCB	DGC	21.92	25.10	22.46	25.61	22.35	22.96	23.08	21.90	23.67
7050	THM TH13 TCB	DGC	21.21	25.22	21.99	26.29	22.29	22.78	23.10	21.97	23.55
7051	THM TH14 TCB	DGC	21.38	26.19	22.88	27.41	23.62	23.71	24.09	21.94	24.65
7052	THM TH16 TCB	DGC	21.30	26.65	23.95	27.72	25.13	23.87	25.40	22.65	24.83
7053	THM TH17 TCB	DGC	21.73	25.74	24.03	26.41	25.02	24.07	24.57	22.18	24.98
7054	THM TH18 TCB	DGC	20.02	22.99	22.20	23.33	23.35	22.04	22.45	20.07	22.98
7060	THM SHUTTER BY 1	DEG	25.85	43.64	33.12	43.03	38.62	30.51	35.26	22.67	35.83
7061	THM SHUTTER BY 2	DEG	6.62	13.88	8.65	13.85	13.28	8.08	7.52	1.63	10.96
7062	THM SHUTTER BY 3	DEG	10.96	38.14	23.58	24.46	30.24	20.77	27.18	9.63	21.34
7063	THM SHUTTER BY 4	DEG	30.60	38.29	35.71	35.41	37.92	33.75	35.53	11.50	34.20
7064	THM SHUTTER BY 5	DEG	15.03	16.	16.25	16.25	15.00	14.57	14.48	5.19	9.81
7065	THM SHUTTER BY 7	DEG	17.14	21.	24.64	24.14	21.96	21.51	21.43	12.71	16.61
7067	THM SHUTTER BY 9	DEG	33.26	38.45	38.44	38.73	39.50	38.44	37.97	26.68	39.68
7068	THM SHUTTER BY 10	DEG	24.68	33.65	28.68	36.36	27.31	27.35	27.68	13.32	30.41
7069	THM SHUTTER BY 11	DEG	39.66	55.79	46.89	59.06	48.96	49.56	50.09	25.45	52.67
7070	THM SHUTTER BY 12	DEG	43.81	55.84	46.63	61.36	45.68	50.12	50.86	36.01	54.62
7071	THM SHUTTER BY 13	DEG	40.39	59.02	46.38	59.61	44.79	45.51	47.18	42.99	49.62
7072	THM SHUTTER BY 14	DEG	34.20	62.55	39.70	70.80	41.91	43.09	45.19	34.85	49.29
7073	THM SHUTTER BY 15	DEG	45.40	75.54	58.74	80.38	64.79	64.38	68.34	58.74	69.51
7074	THM SHUTTER BY 16	DEG	24.50	59.81	48.46	62.87	53.54	46.95	54.84	41.58	53.33
7075	THM SHUTTER BY 17	DEG	39.06	66.93	54.96	70.35	61.88	56.26	59.59	46.72	62.02
7076	THM SHUTTER BY 18	DEG	29.70	48.57	43.15	49.89	51.20	42.64	45.99	27.91	48.76
7080	THM Q1 T ZENER V	VDC	8.19	8.19	8.19	8.19	8.19	8.19	8.19	8.15	8.19
7081	THM Q2 T ZENER V	VDC	8.40	8.40	8.40	8.40	8.40	8.40	8.40	8.36	8.40
7082	THM Q3 T ZENER V	VDC	8.31	8.32	8.31	8.32	8.32	8.31	8.32	8.28	8.31
7083	THM Q1 S ZENER V	VDC	8.31	8.35	8.32	8.36	8.35	8.33	8.33	8.31	8.34
7084	THM Q2 S ZENER V	VDC	8.19	8.21	8.19	8.21	8.20	8.19	8.20	8.17	8.19
~~7085~~	~~THM Q3 S ZENER V~~	~~VDC~~	~~8.15~~	~~8.16~~	~~8.15~~	~~8.15~~	~~8.15~~	~~8.15~~	~~8.15~~	~~8.12~~	~~8.15~~
7090	THM PSM MOUNT	DGC	21.60	23.78	22.54	24.32	22.98	22.55	22.63	19.85	23.15
7091	THM IND ATTITUDE	DGC	19.40	21.07	20.42	20.95	20.88	20.07	20.39	18.06	20.34
7092	THM RBV RADIATOR	DGC	15.65	17.89	17.22	18.55	17.47	17.42	17.39	13.40	17.97
7093	THM RBVC CTR BM	DGC	20.30	22.49	21.61	23.01	21.87	21.70	21.76	17.56	22.34
7094	THM WBVTR ROOT	DGC	12.96	17.10	15.71	17.61	16.07	15.43	15.91	11.73	16.10
7095	THM WBVTR RAD CT	DGC	4.81	8.66	8.17	9.97	8.68	8.36	8.68	3.83	8.99
7096	THM WBVTR STRAP	DGC	16.62	21.06	19.32	21.16	19.66	18.80	19.35	14.63	19.48
7097	THM WB MT BAY 1	DGC	20.56	22.36	19.52	21.11	21.37	18.11	18.19	16.89	18.58
7098	THM WB MAT BAY 1	DGC	20.22	21.05	18.90	20.78	20.39	18.19	18.29	17.03	18.72
7099	THM WBVTR SEP 3	DGC	18.60	22.32	20.55	21.49	21.05	19.49	20.39	17.01	19.99
7100	THM WBVTR SEP 17	DGC	21.31	26.15	23.66	26.28	24.23	23.30	23.95	21.37	24.14
7101	THM WBVTR 1 DENT	DGC	21.49	25.95	23.72	25.50	24.01	22.89	23.48	18.59	23.56
7102	THM WBVTR 2 BAY	DGC	17.46	20.04	18.92	19.66	19.32	18.20	18.90	15.91	18.53
7103	THM WBVTR 2 BY 15	DGC	21.00	25.65	23.16	26.44	23.82	23.29	23.91	21.02	24.11
7104	THM WBVTR 2 CTR	DGC	19.35	23.50	21.51	23.60	21.81	21.10	21.56	17.58	21.74
7105	THM NBTR B SEP 6	DGC	18.06	20.17	19.30	20.22	19.79	19.00	19.26	17.10	19.33
7106	THM NBTR B SEP 1	DGC	20.82	24.88	22.35	25.78	22.89	22.79	23.19	20.86	23.59
7107	THM NBTR BM CTR	DGC	19.37	22.44	21.04	22.86	21.34	21.01	21.27	18.36	21.63
7108	THM MSS MOUNT 14	DGC	19.18	23.89	21.15	24.79	21.70	21.55	22.13	19.70	22.34
7109	THM OA -Y THRUSTER	DGC	22.21	28.11	23.80	29.56	24.69	25.14	25.77	24.27	26.29
7110	THM MSS WBVTR BM	DGC	18.14	21.29	20.06	21.57	20.53	19.76	20.22	17.42	20.34
7111	THM OA +X THRUSTER	DGC	20.30	23.43	19.92	21.55	21.22	19.12	19.30	18.34	19.69
7130	THM AVX P1 T	DGC	15.69	11.23	8.49	12.76	-18.90	11.70	5.26	20.95	12.88
7131	THM AVX P2 T	DGC	10.63	3.63	1.59	23.20	.41	5.03	5.19	26.34	7.15

*** Function 7010 became invalid after an integrated circuit chip failure in the TMP on Orbit 4396.**

FOLDOUT FRAME 2

Table 11-2. Compensation Load History

	Compensation Load Status*							
Orbits	1	2	3	4	5	6	7	8
Launch	0	0	0	0	0	0	0	0
2	0	0	x	x	x	0	x	x
6	x	x	x	x	x	0	x	x
118	0	0	0	0	0	0	0	0
156	x	x	x	x	x	0	x	x
194	0	0	0	0	0	0	0	0
197	x	x	x	x	x	0	x	x
701	x	x	0	x	x	0	x	x
1410	x	x	0	x	x	0	0	x
3484	x	x	x	x	x	0	0	x
3644	x	x	0	x	x	0	0	x
3646	x	x	x	x	x	0	0	x
4177	x	x	0	x	x	0	0	x
6872	x	x	x	x	x	0	0	x
6966	x	x	0	x	x	0	0	x
8291	x	x	x	x	x	0	0	x
8348	x	x	0	x	x	0	0	x
8449	x	x	x	x	x	0	0	x
8472	x	x	0	x	x	0	0	x
8538	x	x	x	x	x	0	0	x
8928	x	x	0	x	x	0	0	x
9898	x	x	x	x	x	0	0	x
10410	x	x	0	x	x	0	0	x
11125	0	0	0	0	0	0	0	0
11126	x	x	0	x	x	0	0	x
11127	0	0	0	0	0	0	0	0
11133	x	x	0	x	x	0	0	x

*Note:
x = ON
0 = OFF

SECTION 12

NARROWBAND TAPE RECORDERS

SECTION 12

NARROWBAND TAPE RECORDERS

The Narrowband Tape Recorder Subsystem continued to operate in a completely satisfactory manner. Since Orbit 1 the two recorders A and B have alternated in Record and Playback modes, generally switching roles each orbit. There is a nominal one minute overlap in Record for continuity.

Since launch, each recorder has had an ON time of 10355 hours and an OFF time of 9370 hours. Each recorder was in the Playback mode for 414 hours; in the Record mode for 9941 hours.

Table 12-1 shows typical telemetry values since launch. They are normal and show no significant trends.

Table 12-2 is a significant sample of the data in this reporting period showing the performance parameters of the Narrowband Recorders. It includes data to evaluate the entire link, including the radio downlink transmitting data from the recorders and the effect of ground station processing. The "mean data rate", nominally 24 kilobits, reflects the motor speed. The slightly slower speed has no effect on fidelity, but only increases operating time by less than one percent. The standard deviation is a measure of effects that would cause "wow" and "flutter" in a major frame. Occasional high values are attributed to transmission link noise. The performance appears excellent and is as good as it has been at any time since launch.

During the pitch flywheel anomaly period the routine operational sequence of the narrowband drop to an emergency level, considerable attention was given to acquiring and maintaining sun illumination of the solar panels. Consequently, at various times during this anomaly, the following procedural aberrations occurred: a partial playback on one orbit; recording by the same recorder on successive orbits; abandonment of recording during the playback of the companion recorder; and for a 2 hour 20 minute period, a spacecraft emergency prevented all narrowband recorder operations.

Table 12-1. Narrowband Tape Recorder Telemetry Values

No.	Function Name	Typical Telemetry Values - Orbits						
		6	1951-1959	3750-3751	5199-5200	7480-7481	9865-9866	10862
10001	A - Motor Cur. (ma)							
	Record	190.10	189.47	189.20	188.76	186.31	186.31	186.31
	P/B	180.00	177.63	178.69	176.64	172.10	172.10	180.00
10101	B - Motor Cur. (ma)							
	Record	193.26	192.79	193.04	195.60	194.79	195.79	198.95
	P/B	188.18	189.47	185.44	189.58	186.31	189.47	187.89
10002	A - Pwr Sup. Cur. (ma)							
	Record	320.56	339.81	338.20	342.48	339.81	339.81	339.81
	P/B	535.78	563.11	568.38	567.30	569.56	569.56	567.75
10102	B - Pwr Sup. Cur. (ma)							
	Record	317.62	333.75	336.05	341.87	343.50	346.75	350.00
	P/B	570.78	567.50	555.63	565.95	574.00	567.50	567.50
10003	A - Rec. Temp. (DGC)	25.47	26.25	24.40	24.56	24.20	22.80	23.60
10103	B - Tec. Temp. (DGC)	24.58	25.38	23.41	23.99	24.54	24.77	23.41
10004	A - Supply (VDC)	-24.47	-24.50	-24.44	-24.41	-24.62	-24.62	-24.62
10104	B - Supply (VDC)	-24.44	-24.57	-24.51	-24.57	-24.57	-24.29	-24.29

Table 12-2. Narrowband Recorder Subsystem Performance

Orbit No.	% Data		Data Rate		RCDR
	Bad	Missing	Mean	Std. Dev.	
10304	0.00	0.55	-23.88	0.02	A
10307	0.01	0.00	-23.87	0.02	A
10308	0.00	0.00	-23.84	0.02	B
10310	0.00	0.00	-23.84	0.02	B
10311	0.01	0.00	-23.87	0.02	A
10356	0.00	0.00	-23.84	0.02	B
10359	0.00	0.13	-23.88	0.03	A
10360	0.00	0.15	-23.85	0.02	B
10362	0.00	0.00	-23.88	0.06	A
10365	0.00	0.00	-23.88	0.02	A
10448	0.25	0.00	-23.86	0.61	A
10449	0.01	0.30	-23.84	0.02	B
10450	0.00	0.00	-23.87	0.04	A
10451	0.01	0.00	-23.84	0.02	B
10452	0.00	0.00	-23.87	0.02	A
10516	0.25	0.00	-23.86	0.61	B
10565	0.00	0.00	-23.87	0.02	A
10568	0.00	0.13	-23.86	0.03	B
10574	0.01	0.23	-23.84	0.02	B
10575	0.00	0.62	-23.88	0.02	A
10652	0.00	0.00	-23.86	0.03	B
10654	0.00	0.00	-23.88	0.03	A
10655	0.01	0.00	-23.86	0.03	B
10656	0.00	0.00	-23.86	0.02	A
10658	0.00	0.30	-23.86	0.02	A
10742	0.00	0.14	-23.88	0.02	A
10743	0.00	0.25	-23.84	0.02	B
10746	0.00	0.00	-23.86	0.02	A
10749	0.00	0.15	-23.85	0.02	B
10752	0.33	0.13	-23.85	1.04	B
10837	0.00	0.00	-23.84	0.02	B
10838	0.00	0.00	-23.86	0.02	A
10847	0.00	0.25	-23.88	0.03	A
10848	0.14	0.00	-23.85	0.51	B
10853	0.00	0.00	-23.87	0.02	A

Orbit No.	% Data		Data Rate		RCDR
	Bad	Missing	Mean	Std. Dev.	
10951	0.00	0.42	-23.88	0.05	A
10952	0.01	0.26	-23.84	0.02	B
10953	0.01	0.00	-23.87	0.02	A
10954	0.00	0.00	-23.84	0.02	B
10955	0.00	0.00	-23.86	0.02	A
11050	0.01	0.24	-23.84	0.02	B
11051	0.01	0.00	-23.87	0.02	A
11052	0.01	0.00	-23.84	0.02	B
11053	0.00	0.00	-23.87	0.02	A
11056	0.00	0.51	-23.86	0.03	B
11154	0.00	0.00	-23.86	0.03	B
11156	0.00	0.00	-23.89	0.02	A
11157	0.00	0.00	-23.84	0.02	B
11158	0.00	0.00	-23.87	0.02	A
11160	0.00	0.30	-23.86	0.02	A
11251	0.00	0.30	-23.85	0.04	B
11252	0.00	0.13	-23.85	0.03	A
11254	0.00	0.00	-23.85	0.02	A
11255	0.01	0.00	-23.87	0.02	B
11256	0.00	0.00	-23.84	0.04	A
11350	0.17	0.34	-23.87	0.70	A
11351	0.01	0.00	-23.84	0.02	B
11353	0.00	0.00	-23.84	0.02	B
11354	0.01	0.00	-23.87	0.02	A
11355	0.00	0.30	-23.84	0.02	B
11446	0.00	0.36	-23.87	0.02	A
11447	0.00	0.26	-23.85	0.03	B
11449	0.15	0.00	-23.89	0.46	A
11450	0.01	0.00	-23.84	0.03	B
11451	0.53	0.00	-23.86	0.87	A
Sample From Prior Orbits					
953	0.00	0.00	-23.82	0.02	
1320	0.01	0.00	-23.82	0.03	
2091	0.21	0.23	-23.85	0.57	
2496	0.00	0.25	-23.85	0.60	
4056	0.00	0.13	-23.85	0.03	
6050	0.01	0.00	-23.87	0.03	
7650	0.00	0.00	-23.84	0.02	
8750	0.00	0.00	-23.87	0.02	
9950	0.01	0.00	-23.86	0.02	
10145	0.01	0.00	-23.86	0.03	

SECTION 13

WIDEBAND TELEMETRY SUBSYSTEM

SECTION 13

WIDEBAND TELEMETRY SUBSYSTEM

The Wideband Telemetry Subsystem has operated successfully since turn-on in Orbit 12. This Subsystem consists of two independent and similar 10/20 watt S-Band FM transmitters WPA-1 and 2 with associated filters, antennas, modulators and signal conditioning equipment.

WPA No. 1 was used with RBV input until Orbit 196 when the RBV power input circuit failed. WPA-1 was used again, this time with MSS input, between Orbits 1890 and 2099 because its operating frequency was less likely to interfere with the Apollo-17 launch operations. The cumulative ON-time for WPA No. 1 is 31 hours, 55 minutes and 9 seconds. When used after Orbit 20 it operated in the 20-watt mode.

WPA No. 2 has been used with MSS input since its initial turn-ON in the 10 watt mode during Orbit 12. It was changed to the 20 watt mode in Orbit 30, and has operated at this power ever since. It was not used between Orbits 1890 and 2099. The cumulative ON time for WPA No. 2 is 1512 hours, 55 minutes and 48 seconds. Table 13-1 gives the telemetry values for both Wideband Power Amplifier units.

All values are normal and show no significant trends.

Figure 13-1 shows the power delivered to Goldstone from two selected points in space (identical azimuth, elevation and slant ranges) as a function of time. Variations in ground equipment performance, calibration procedures, and readout accuracy are the probable causes of the saw-tooth appearance. The larger variations in AGC levels have been attributed to equipment substitutions or adjustments. Within the limits of repeatable calibration and equipment adjustment the power delivered to Goldstone appears to have been generally constant since launch. The power output of the WPA-2 as measured by telemetry (Table 13-1) has remained level since launch at about 43. 5 dBm. At about the 41st cycle, Goldstone began using their 85-foot antenna instead of the normal 30-foot antenna accounting for the 6 to 10 dB rise shown in later cycles.

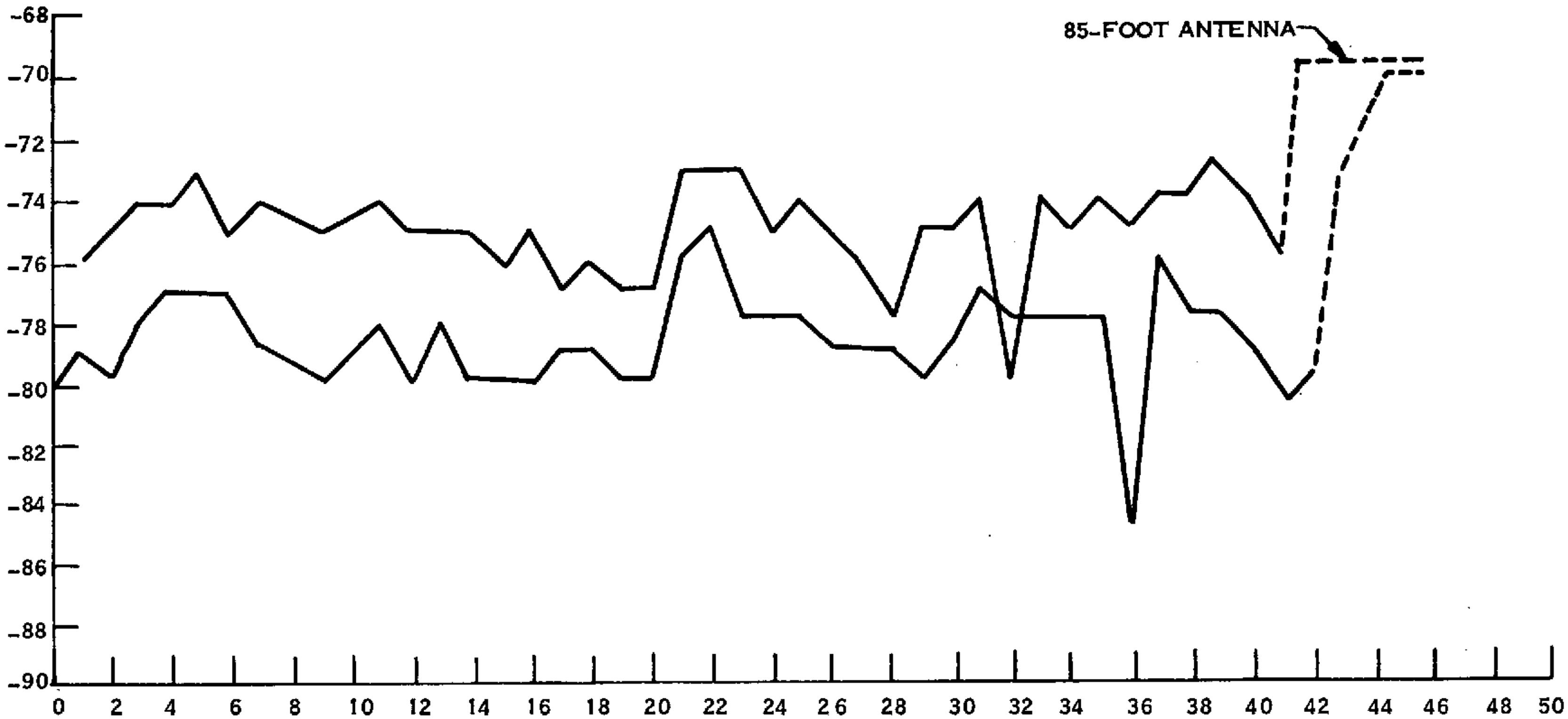

Figure 13-1. AGC Readings at Goldstone with 30-Foot Antenna Wide Band Power Amplifier

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Table 13-1. Wideband Modulator Telemetry Values

WBPA-1

Function			Orbits			
Number	Name		26	1894	1944	2095
12001	Tmpt TWT Coll.	(DgC)	35.7	39.20	39.90	39.90
12002	Helix Current	(Ma)	6.08	6.49	6.58	6.78
12003	TWT Cath. Curr.	(Ma)	45.89	43.54	43.48	45.01
12004	Forward Pwr	(DBM)	43.18	42.88	42.61	43.15
12005	Reflected Pwr	(DBM)	34.95	34.99	34.80	35.21
12227	Loop Str. AFC ConVolt (1)	(MHz)	-0.39	-1.29	-0.86	-0.67
12229	Mod Temp VCO	(DgC)	21.93	20.31	20.88	20.39
12232	+15 VDC Pwr Sup A (2)	(TMV)	2.69	2.69	2.65	2.62
12234	-15 VDC Pwr Sup A	(TMV)	5.98	5.96	5.73	5.78
12235	+5 VDC Pwr Sup A	(TMV)	3.94	3.94	3.94	3.95
12238	-5 VDC Pwr Sup A	(TMV)	5.28	5.26	5.18	5.12
12240	-24 VDC Unreg Volt A	(TMV)	5.56	5.51	5.42	5.49
12242	Inv. Temp	(DgC)	20.60	23.43	24.71	24.04

WBPA-2

Function									
Number	Name		33	2595	4096	10182	10602	10727	10862
12101	Temp TWT Coll. (Max)	(DgC)	35.38	34.80	34.24	35.96	35.96	34.23	35.96
12102	Helix Current	(Ma)	7.32	7.46	7.70	7.71	7.67	7.65	7.75
12103	TWT Cath. Cur.	(Ma)	44.30	42.52	43.85	42.79	42.72	42.21	43.17
12104	Forward Pwr	(DBM)	43.57	43.35	43.57	43.47	43.47	43.37	43.47
12105	Reflected Pwr	(DBM)	31.59	32.11	32.79	32.91	32.62	32.50	32.89
12228	Loop Str AFC Con Volt (1)	(MHz)	1.11	-1.01	-0.78	-1.14	-1.12	-1.21	-.82
12229	Mod Temp VCO	(DgC)	21.70	24.04	20.88	22.25	21.50	23.12	22.19
12232	+15 VDC Pwr Sup A (2)	(TMV)	2.68	2.58	2.69	2.69	2.69	2.69	2.69
12234	-15 VDC Pwr Sup A	(TMV)	5.90	5.71	5.98	5.91	5.92	5.93	5.93
12236	+5 VDC Pwr Sup A	(TMV)	3.97	3.91	4.01	4.02	4.01	3.95	3.98
12239	-5 VDC Pwr Sup A	(TMV)	5.24	5.05	telemetry point defective				
12240	-24.5 VDC Unreg Volt A	(TMV)	5.43	5.33	5.52	5.43	5.46	5.50	5.48
12242	Inv. Temp	(DgC)	23.03	22.95	22.96	23.99	23.86	23.07	22.61

(1) Satisfactory if not zero or -7.5 (2) B Power Supply not yet used in orbit

SECTION 14

ATTITUDE MEASUREMENT SENSOR

SECTION 14

ATTITUDE MEASUREMENT SENSOR

Telemetry output of the AMS continues to be normal and in good agreement with the ACS Subsystem.

Table 14-1 compares measurements made by the monitoring AMS passive radiometric balance sensors with the fine error signals produced by the ACS system which actually controls the spacecraft. AMS function 3001 (minus Roll position) is compared with ACS function 1030 (mean Roll fine error); and AMS function 3003 (minus Pitch position) is compared with ACS function 1041 (mean pitch fine error). As can be seen, the agreement is close in both cases: about 0.11 degrees in roll and 0.03 degrees in pitch. The actual agreement is even closer. This is because in derivation of the AMS values only minus values were included, while the derivation of the ACS values included consideration of the positive values of pitch and roll. Both roll and pitch were predominantly negative during this reporting period, but the effect of any positive periods, including sun transients, 15 to move the ACS values higher (lower negative values) away from the AMS values.

Table 14-1. Comparison of AMS with ACS Measurements

	Roll (Deg)			Pitch (Deg)		
Orbit	AMS 3001	ACS 1030	Δ	AMS 3003	ACS 1041	Δ
10202	-.35	-.22	.13	-.12	-.11	.01
10403	-.32	-.20	.10	-.14	-.12	.02
10602	-.39	-.32	.07	-.13	-.11	.02
10800	-.33	-.21	.12	-.13	-.09	.04
11000	-.38	-.24	.14	-.12	-.09	.03
11200	-.32	-.19	.13	-.12	-.06	.06
11401	-.27	-.17	.10	-.85	-.82	.03
Avg Δ			.1128			0.03

Table 14-2. gives typical AMS telemetry values.

Table 14-2. AMS Temperature Telemetry Summary

Function No.		Units	Orbit							
			35	2600	5099	7650	10182	10592	11032	11456
3004	Case - Temp 1	°C	18.92	20.05	19.42	20.29	19.71	19.41	19.41	19.96
3005	Assembly - Temp 2	°C	19.15	20.27	19.76	20.68	19.96	19.79	19.68	20.26

SECTION 15

WIDEBAND VIDEO TAPE RECORDERS

SECTION 15

WIDEBAND VIDEO TAPE RECORDERS

The Wideband Video Tape Recorder Subsystem consists of two components. WBVTR-1 and WBVTR-2. WBVTR-2 failed in Orbit 148 after 9 hours, 26 minutes and 33 seconds of satisfactory flight performance.

WBVTR-1 operated with RBV through Orbit 196 after which it was re-configured to operate with MSS. The WBVTR-1 has had 4 major disruptions in its service, generally characterized by high headwheel current (above 0.70 amperes) and high Minor Frame Sync Error counts (above 300). These disruptions occurred during:

Orbit 3469 on 29 March 1973

Orbit 8253 on 7 March 1974

Orbit 8845 on 19 April 1974

Orbit 9881 on 2 July 1974

After Orbit 9881, the tape recorder was temporarily removed from operational service for engineering tests. These tests were suspended after Orbit 10861 on 10 September 1974. Another, possibly final, series of tests may be started soon.

The usage of the tape by footage is shown in Figure 15-1.

Telemetry values for all functions are shown in Table 15-1. Values for WBVTR-2 are also shown for convience and completeness. Some of the telemetered functions have different values for different operating modes: Playback, Standby, Rewind and Record. These are shown in Table 15-2, showing stable operations through Orbit 9881 except for the four occurances of anomolies listed above.

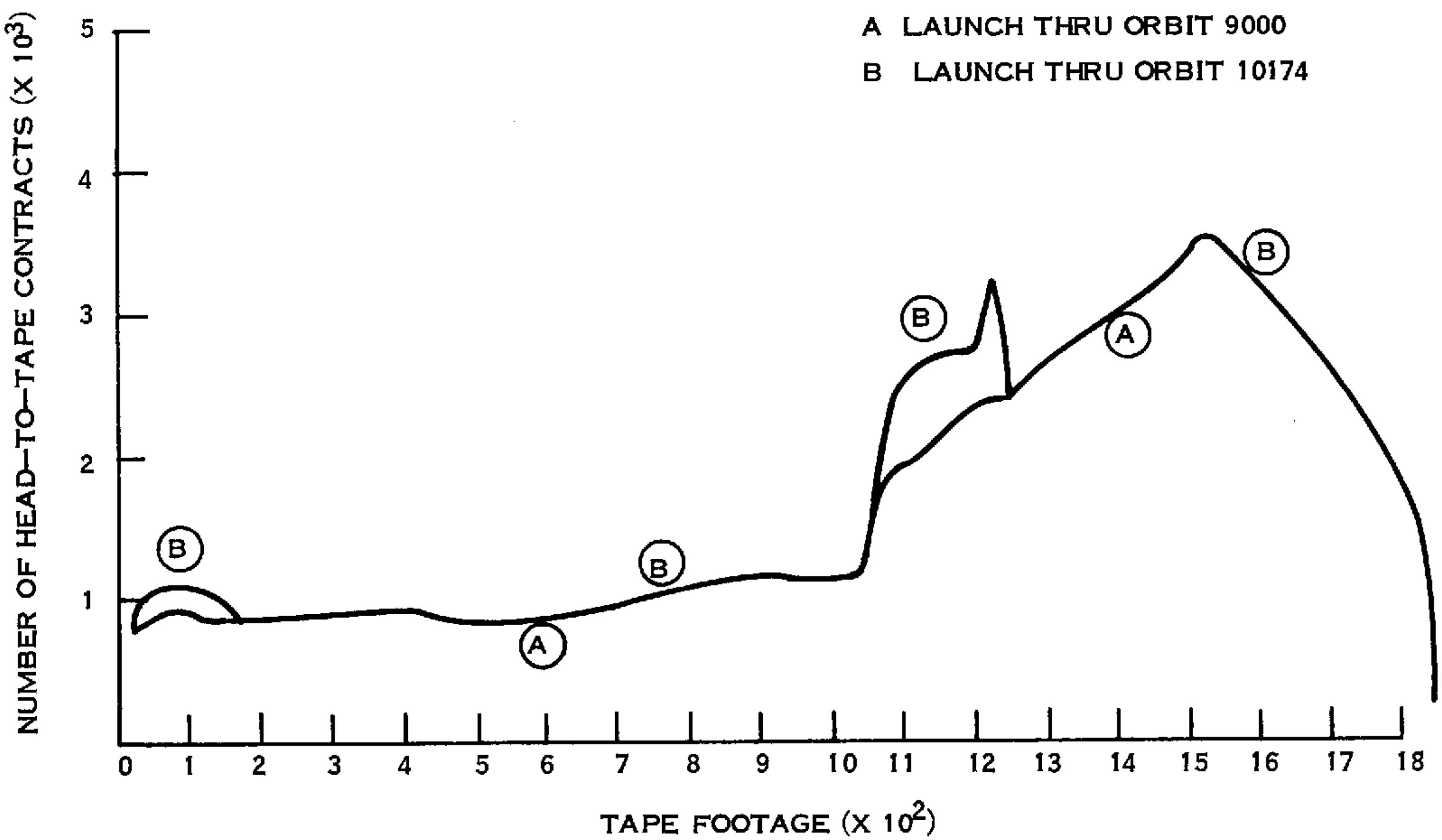

Figure 15-1. Tape Usage by Footage

Table 15-1. WBVTR Telemetry Values

WBVTR-1 Functions			Telemetry Value in Orbits						
Number	Name		15	2599	5029	10088	10602	10729	10862
13022	Pressure Trans	(PSI)	16.12	16.38	16.11	15.98	15.97	15.97	15.96
13023	Temp Trans	(DgC)	19.50	25.05	21.84	20.81	20.64	20.39	20.09
13024	Temp Elec	(DgC)	22.78	25.34	20.44	23.72	16.85	16.84	16.34
13026	Capstan Speed	(%)	100.51	98.25	101.93	102.84	88.24	101.39	90.18
13027	Headwheel Speed	(%)	95.16	96.84	95.17	93.47	85.04	90.26	90.81
13028	Capstan Mot I	(Amp)	0.25	0.26	0.27	0.28	0.20	0.22	0.24
13029	Input P/B Volt.	(VPP)	0.72	0.41	0.45	0.33	0.54	0.38	0.56
13030	Headwheel Mot I	(Amp)	0.55	0.55	0.54	0.55	0.51	0.54	0.53
13031	Rec Input I	(Amp)	3.15	3.31	3.68	2.82	2.64	2.73	2.79
13032	Lim Volt Out	(VPP)	1.44	1.42	1.45	1.17	1.32	1.32	1.33
13033	Servo Volt	(%)	50.03	50.23	50.74	47.71	49.97	49.96	48.98
13034	+5.6 VDC Conv	(VDC)	5.66	5.71	5.68	5.65	5.86	5.84	5.78

WBVTR-2 Functions			Orbit Number			
Number	Name		15	64	103	147
13122	Pressure, Trans	(PSI)	15.99	16.25	16.25	16.11
13123	Temp Trans	(DgC)	18.46	19.19	20.72	21.09
13124	Temp Elec	(DgC)	21.50	22.00	24.00	21.92
13126	Capstan Speed	(%)	99.91	100.53	100.80	99.38
13127	Headwheel Speed	(%)	94.16	95.48	97.64	98.78
13128	Capstan Mot I	(Amp)	0.17	0.24	0.24	0.28
13129	Input P/B Volt	(VPP)	0.66	0.63	0.62	0.61
13130	Headwheel Mot I	(Amp)	0.55	0.59	0.52	0.53
13131	Rec Input I	(Amp)	3.70	3.53	3.07	3.43
13132	Lim Volt Out	(VPP)	1.34	1.41	1.41	1.39
13133	Servo Volt	(%)	49.97	49.60	49.80	49.48
13134	+5.6 VDC	(VDC)	5.47	5.64	5.58	5.59

Table 15-2. Function Values by Mode in Orbit

Function/Description	Orbits 913	2379	3781	4876	7385	7953	9866	10862
13029 - Input P/B Voltage								
Record	0	0	0	0	0	0	0	0
Playback	0.40	0.45	0.58	0.53	0.48	0.48	0.67	0.69
Rewind	0	0	0	0	0	0	0	0
Standby	0	0	0	0	0	0	0	0
13028 - Capstan Motor Current								
Record	0.23	0.24	0.26	0.23	0.26	0.25	0.25	0.28
Playback	0.25	0.25	0.26	0.26	0.28	0.23	0.28	0.26
Rewind	0.23	0.20	0.20	0.17	0.17	0.18	0.18	0.20
Standby	0	0	0	0	0	0	0	0
13030 - Headwheel Motor Current								
Record	0.58	0.55	0.58	0.58	0.58	0.58	0.60	0.57
Playback	0.56	0.55	0.62	0.56	0.55	0.58	0.59	0.54
Rewind	0.47	0.44	0.46	0.45	0.43	0.45	0.46	0.43
Standby	0.47	0.44	0.44	0.44	0.44	0.44	0.44	0.44
13031 - Recorder Input Current								
Record	3.70	3.63	3.46	3.40	3.40	3.30	3.30	3.20
Playback	3.85	3.89	3.74	3.76	3.69	3.56	3.59	3.56
Rewind	2.20	2.18	2.07	1.89	1.94	1.85	1.85	1.85
Standby	1.96	2.08	1.78	1.73	1.88	1.98	1.85	1.85
13033 - Servo Voltage								
Record	0	0	0	0	0	0	0	0
Playback	50.30	50.37	50.70	50.78	50.76	50.96	50.86	51.05
Rewind	0	0	0	0	0	0	0	0
Standby	0	0	0	0	0	0	0	0
13026 - Capstan Motor Speed								
Record	98.50	96.70	102.88	103.41	103.41	105.09	104.53	106.49
Playback	98.40	97.20	101.3	102.40	101.16	104.53	103.41	103.96
Rewind	101.70	101.1	99.20	98.90	99.48	98.36	98.36	98.36
Standby	0	0	0	0	0	0	0	0
13027 - Headwheel Motor Speed								
Record	97.10	100.0	94.23	93.64	93.06	91.88	91.88	90.70
Playback	97.10	97.80	93.69	92.93	93.06	90.70	91.29	90.70
Rewind	100.72	100.70	95.10	93.60	93.64	91.88	91.88	41.88
Standby	100.70	102.80	95.41	96.00	95.41	90.12	93.65	93.06

SECTION 16

RETURN BEAM VIDICON SYSTEM

SECTION 16

RETURN BEAM VIDICON

The Return Beam Vidicon (RBV) Subsystem operated normally fron turn-on in Orbit 19 to Orbit 196 when it failed to respond to a turn-off command because of a probable failure of a relay in the Power Switching Module. The RBV itself was not the cause of the failure, nor was it affected by the failure. The RBV has not been reactivated since Orbit 196, but it is capable of operation through individual component power switching. An assessment of the RBV performance was given in ERTS-1 Flight Evaluation Report 23 July to 23 October 1972. For completeness and convenience, the telemetry values are repeated in Table 16-1.

Table 16-1. RBV Telemetry Values

FUNCTION		ORBITS				
NO.	NAME	T/V VALUE	26	85	149	196
14001	CCC Board Temp. (DgC)	(1)	18.61	20.04	19.30	19.53
14002	CCC Pwr. Sup. Temp (DgC)	(1)	19.93	21.58	20.70	21.21
14003	±15 VDC Sup. (TMV)	3.95	3.69	3.95	3.78	3.95
14004	∓6V-5.25 VDC Sup. (TMV)	3.05	2.84	2.93	2.98	3.05
14100	VID OUT CAM 1 (TMV)	1.06	1.04	1.15	1.13	1.12
14200	VID OUT CAM 2 (TMV)	1.09	1.05	1.26	1.23	1.24
14300	VID OUT CAM 3 (TMV)	1.05	1.03	1.21	1.19	1.20
14102	Comb. Align I Com 1 (TMV)	3.95	3.67	3.94	3.87	3.94
14202	Comb. Align I Com 2 (TMV)	3.92	3.90	3.91	3.89	3.91
14302	Comb. Align I Com 3 (TMV)	4.04	3.75	4.03	3.80	4.03
14103	Cam 1 Elec Temp. (DgC)	(1)	20.84	23.37	22.64	25.38
14203	Cam 2 Elec Temp. (DgC)	(1)	18.64	21.06	20.62	22.87
14303	Cam 3 Elec Temp. (DgC)	(1)	21.05	23.61	23.23	25.57
14104	Cam 1 LV Pwr Sup T. (DgC)	(1)	21.71	23.94	23.49	25.92
14204	Cam 2 LV Pwr Sup T. (DgC)	(1)	18.38	20.63	19.40	23.30
14304	Cam 3 LV Pwr Sup T. (DgC)	(1)	20.75	23.02	22.73	25.67
14105	Cam 1 Def. + 10 VDC (TMV)	4.01	3.73	4.00	3.77	4.00
14205	Cam 2 Def. + 10 VDC (TMV)	4.00	3.71	3.98	3.77	3.98
14305	Cam 3 Def. + 10 VDC (TMV)	3.97	3.95	3.95	4.02	3.95
14106	Cam 1 + 6V -6.3 VDC (TMV)	3.71	3.45	3.70	3.61	3.70
14206	Cam 2 + 6V -6.3 VDC (TMV)	3.69	3.42	3.67	3.49	3.67
14306	Cam 3 +6V -6.3 VDC (TMV)	3.73	3.47	3.72	3.47	3.72
14107	Cam 1 Telec I (TMV)	2.62	2.50	2.54	2.55	2.64
14207	Cam 2 Telec I (TMV)	2.65	2.53	2.56	2.41	2.64
14307	Cam 3 Telec I (TMV)	2.64	2.54	2.51	2.45	2.61
14108	Cam 1 Vid Fil I (TMV)	2.47	2.30	2.36	2.38	2.46
14208	Cam 2 Vid Fil I (TMV)	2.54	2.37	2.52	2.39	2.52
14308	Cam 3 Vid Fil I (TMV)	2.61	2.44	2.60	2.53	2.60
14110	Cam 1 TARVOLT (TMV)	3.43	3.42	3.42	3.45	3.42
14210	Cam 2 TARVOLT (TMV)	3.36	3.13	3.22	3.26	3.32
14310	Cam 3 TARVOLT (TMV)	3.47	3.23	3.46	3.45	3.47
14113	Cam 1 Vert Def V (TMV)	2.96	2.75	2.90	2.85	2.97
14213	Cam 2 Vert Def V (TMV)	3.00	2.86	2.98	2.86	3.01
14313	Cam 3 Vert Def V (TMV)	3.45	3.45	3.47	3.37	3.45
14114	Cam 1 Vid FPT (DgC)	(1)	18.15	20.77	17.91	20.99
14214	Cam 2 Vid FPT (DgC)	(1)	20.62	20.11	20.52	20.62
14314	Cam 3 Vid FPT (DgC)	(1)	18.54	20.88	19.08	20.20
14115	Cam 1 Foc Coil T (DgC)	(1)	17.71	21.67	18.74	19.70
14215	Cam 2 Foc Coil T (DgC)	(1)	17.70	21.60	19.25	19.97
14315	Cam 3 Foc Coil T (DgC)	(1)	18.03	22.09	19.88	20.56

(1) Thermo-Vacuum temperatures for these functions were not reported.

SECTION 17

MULTISPECTRAL SCANNER SUBSYSTEM

SECTION 17

MULTISPECTRAL SCANNER SUBSYSTEM

The Multispectral Scanner Subsystem (MSS) has operated satisfactorily since initial turn-on in Orbit 20. The MSS has imaged over 27% of the earth's surface between the latitudes of 81.42°, including over 78% of the land masses, and 7% of the oceans with a cloud cover of 30% or less. Many of these scenes were repeatedly imaged, some in the United States as many as 45 times, although the cloud cover of some of these repetitive scenes exceeded 30%. A very large percentage of every continent has been imaged. Figure 17-1 is a computer derived map showing how many scenes were imaged at each geographic location since launch. Along the right-hand edge of the map is listed the frame number - frame 1 being at the northern-most extreme, frame 61 centered on the equator, and frame 121 at the southernmost extreme, thus giving latitude. Along the top of the map is the number of the reference orbit which fixes longitude. The land masses are distorted to fit this map projection.

Figure 17-2 shows how many scenes were acquired during this reporting period.

Table 17-1 shows typical telemetry values during this quarter. All functions are normal. The maximum MUX temperature to date has been 33.25°C which occurred in August 1973, when the MSS was accidentally left ON at LOS, and was turned OFF by the 32-minute back-up timer. The calibration lamp current has remained at 1.12 TMV from pre-launch to the present.

Time Code extracted from de-muxed data was observed and found normal.

The response history of each sensor to a selected input radiance level is shown in Figure 17-3 (1) thru (8). Only one radiance level for each sensor has been selected for graph presentation, but the other five levels selected in the computer program to determine the cal wedge shape have been analyzed and found to be consistent with the data presented.

In general, the graphs show an early gradual decrease in sensor response from launch to Orbit 1000, and essentially unchanged response thereafter. The notable exception is sensor 13.

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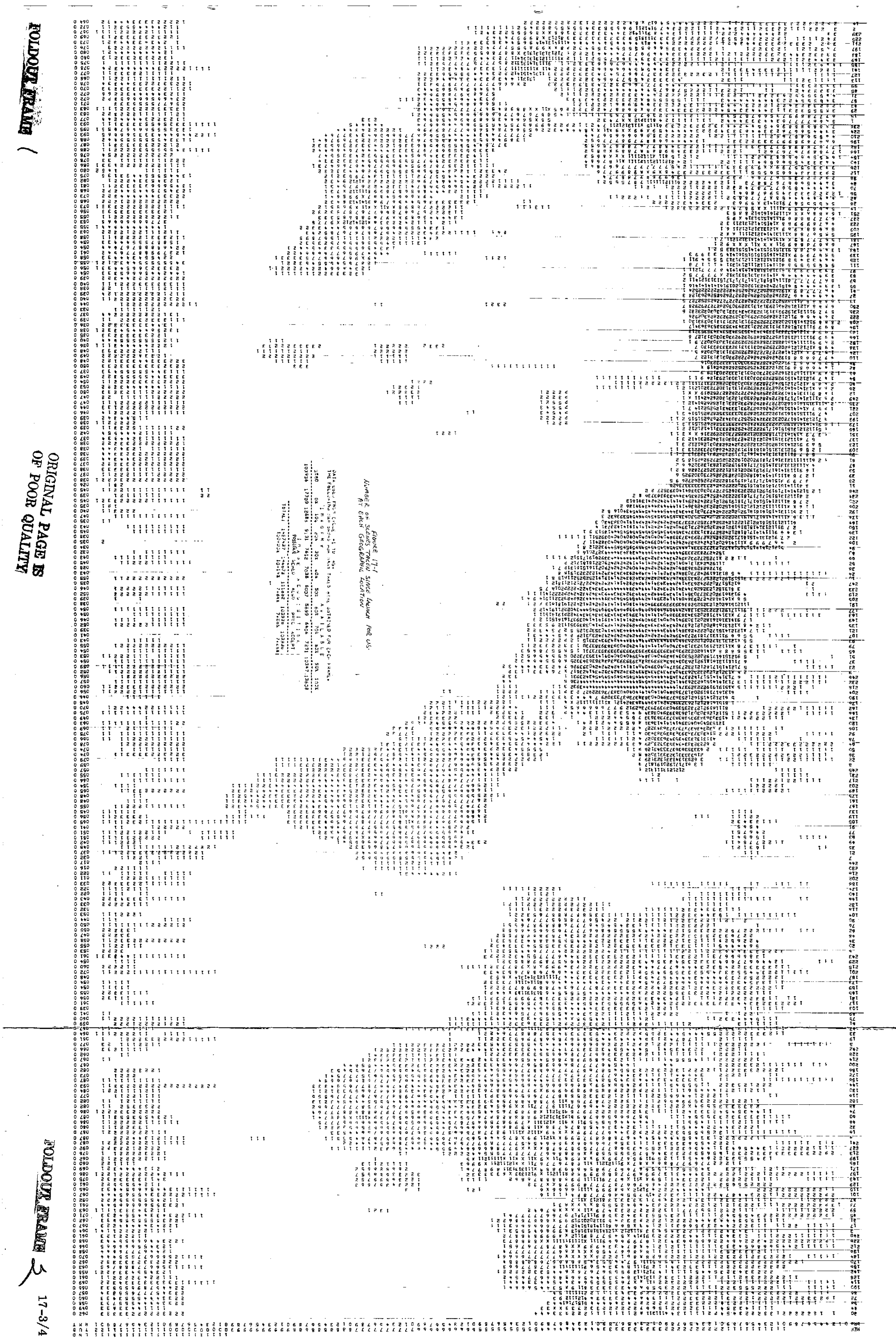

Figure 17-1. Number of Scenes Taken Since Launch at Each Geographic Location

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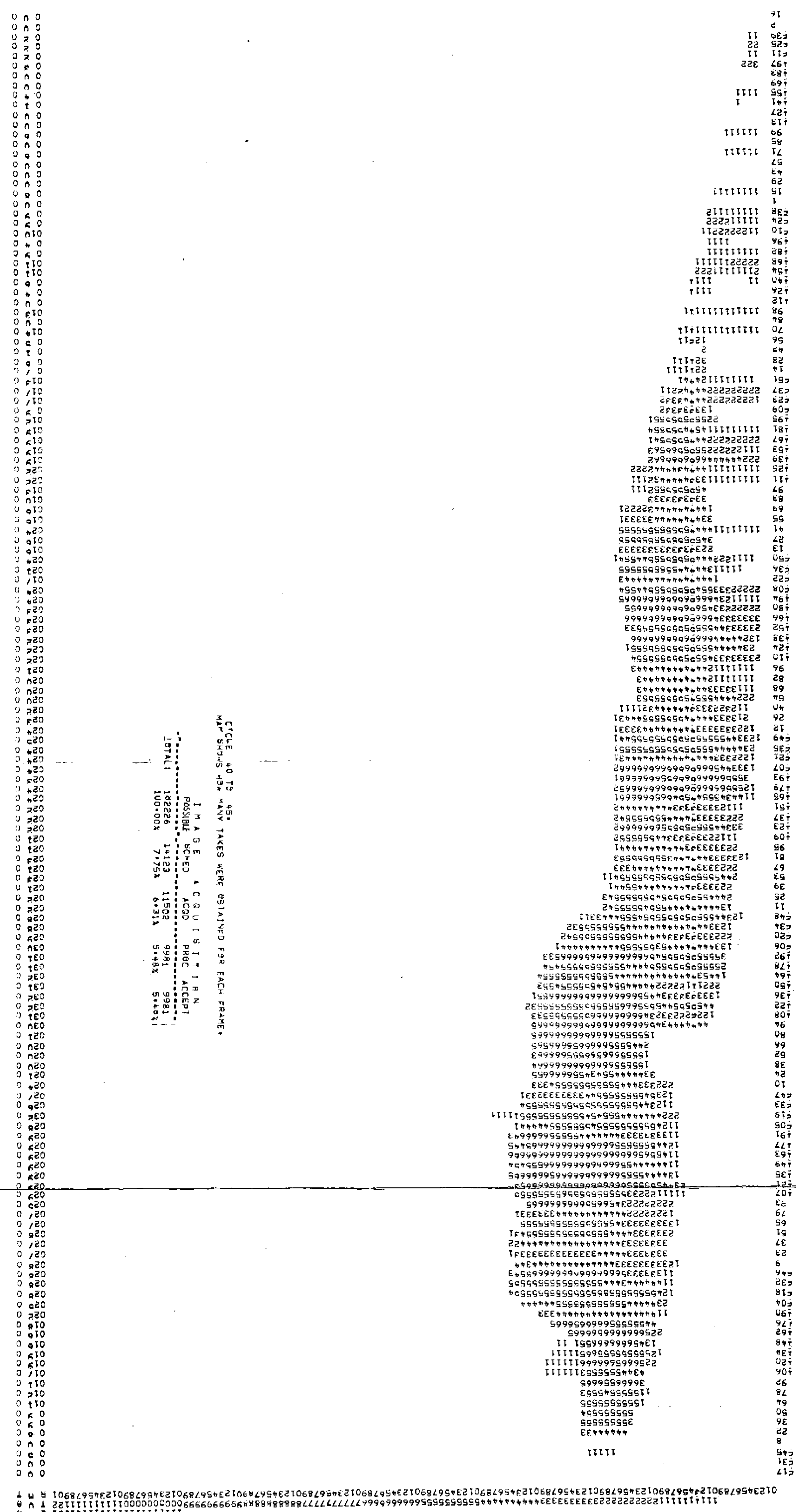

Figure 17-2. Number of Scenes Taken This Quarter at Each Geographic Location

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Table 17-1. MSS Telemetry Values

Function No.	Name	Telemetry Values in Orbits 20	2599	5060	10182	10597	11032	11452
15044	FOPT 2 T (DGC)	17.46	21.03	19.84	20.46	19.75	20.61	21.08
15046	ELEC CVR T (DGC)	19.37	23.53	21.83	22.73	21.96	22.88	23.32
15048	SCAN MIR REG T (DGC)	16.35	22.84	19.77	21.18	20.48	21.59	21.79
15050	SCAN MIR DR. COIL T (DGC)	15.94	21.97	19.30	20.65	19.78	21.00	21.33
15052	ROT SHUT HSG T (DGC)	16.91	20.88	20.07	20.68	20.23	21.01	21.42
15043	FOPT 1 T (DGC)	17.67	21.17	20.01	20.65	19.93	20.74	21.17
15045	MUX PWR CASE T (DGC)	21.19	26.84	22.03	24.09	23.87	24.33	24.38
15047	PWR SUP T (DGC)	17.41	21.95	20.00	21.00	20.21	21.17	21.50
15049	SCAN MIR DR. ELC T (DGC)	16.12	22.76	19.41	20.98	20.23	21.36	21.61
15051	SCAN MIR HSG T (DGC)	15.60	21.46	19.05	20.16	19.49	20.73	20.94
15040	MUX -6 VDC (TMV)	4.03	4.03	4.03	4.03	3.98	4.03	4.03
15042	AVE DENS DATA (TMV)	1.67	2.52	2.13	2.27	2.05	2.04	1.87
15054	CAL IAMP CUR A (TMV)	1.12	1.12	1.12	1.12	1.12	1.12	1.12
15056	BAND 2 ± 15 VDC (TMV)	5.10	5.10	5.10	5.10	5.04	5.10	5.10
15058	BAND 4 ± 15 VDC (TMV)	5.10	5.10	5.10	5.10	5.04	5.10	5.10
15060	+ 12 -6 VDC REG (TMV)	4.82	4.92	5.02	4.90	4.97	5.02	4.89
15062	+ 19 VDC REC OUT (TMV)	4.80	4.90	4.90	4.89	4.97	4.91	4.87
15064	BAND 1 HV A (TMV)	5.10	5.12	5.16	5.12	5.12	5.12	5.12
15066	BAND 2 HV A (TMV)	4.50	4.52	4.52	4.52	4.52	4.52	4.52
15068	BAND 3 HV A (TMV)	4.60	4.63	4.62	4.62	4.62	4.62	4.62
15070	SHUT MOT CON OUT (TMV)	2.43	2.46	2.44	2.44	2.47	2.44	2.43
15041	S/D CONV REF V (TMV)	5.93	5.82	5.93	5.80	5.87	5.93	5.93
15053	SCAN MIR REG V (TMV)	4.42	4.53	4.51	4.49	4.56	4.50	4.48
15055	BAND 1 ± 15V (TMV)	4.97	4.97	4.97	4.97	4.92	4.97	4.97
15057	BAND 3 ± 15V (TMV)	5.00	5.00	5.00	5.00	4.94	5.00	5.00
15059	-15 VDC TEL. (TMV)	5.02	5.02	5.02	5.02	5.02	5.02	5.02
15061	± 5 VDC LOGIC REG (TMV)	4.82	4.80	4.81	4.79	4.77	4.78	4.80
15063	-19 VDC REG OUT (TMV)	3.43	3.50	3.39	3.48	3.50	3.50	3.48
15071	SCAN MIR DR. CLK (TMV)	1.93	1.97	1.97	1.96	1.98	1.97	1.96

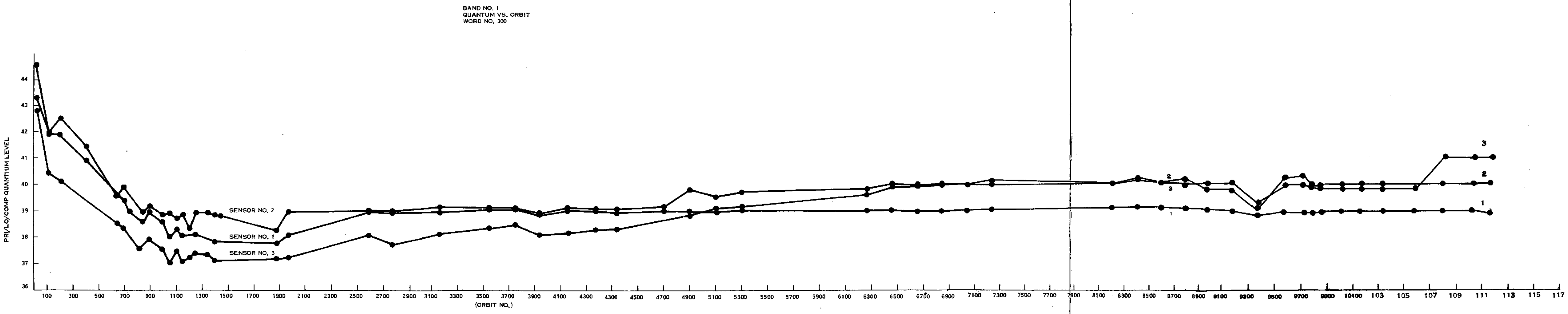

Figure 17-3(1). Quantum vs. Orbit

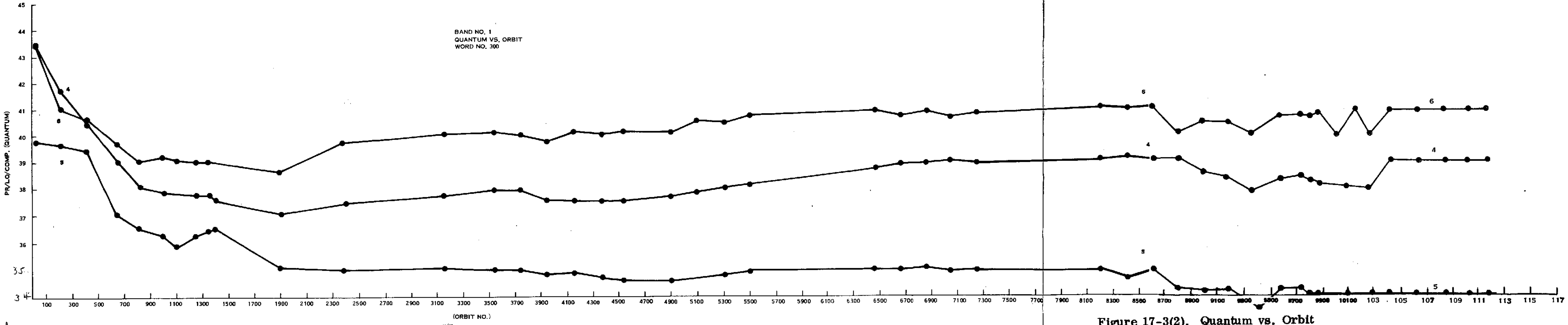

Figure 17-3(2). Quantum vs. Orbit

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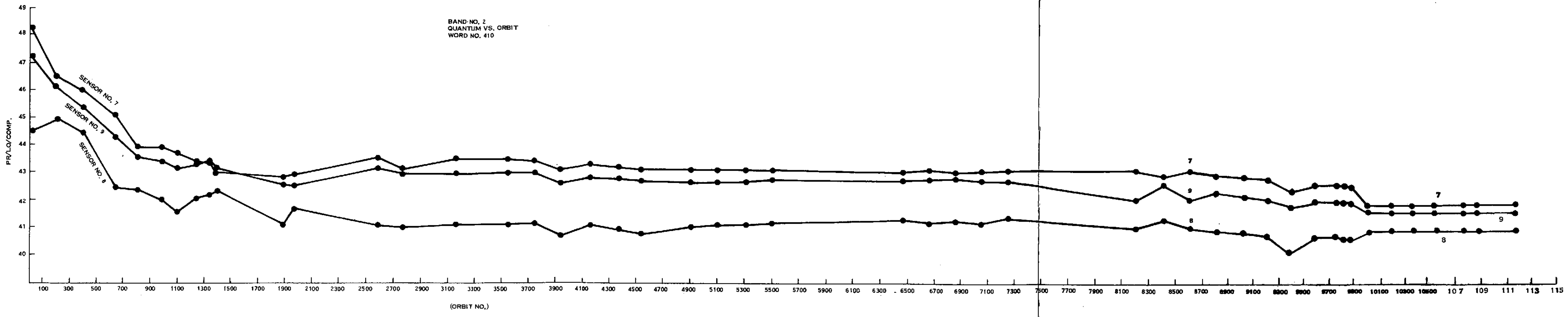

Figure 17-3(3). Quantum vs. Orbit

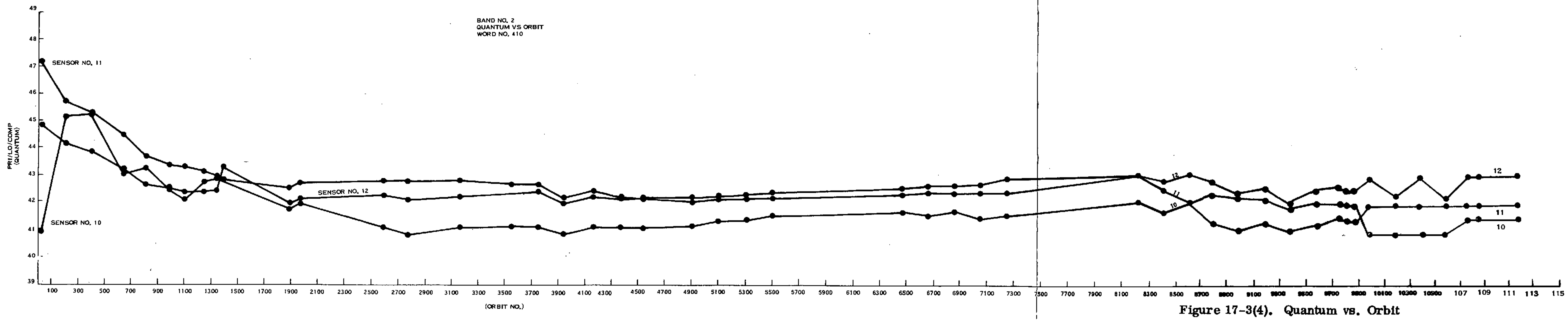

Figure 17-3(4). Quantum vs. Orbit

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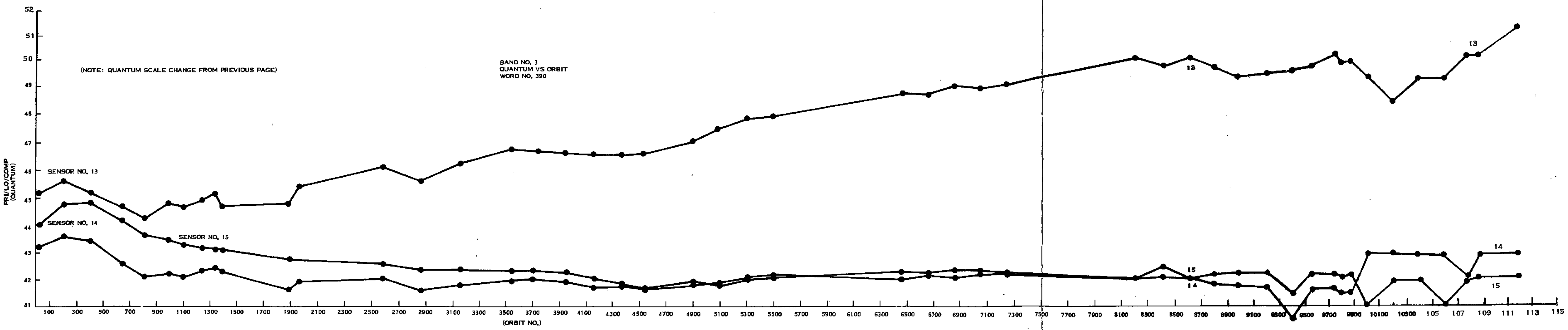

Figure 17-3(5). Quantum vs. Orbit

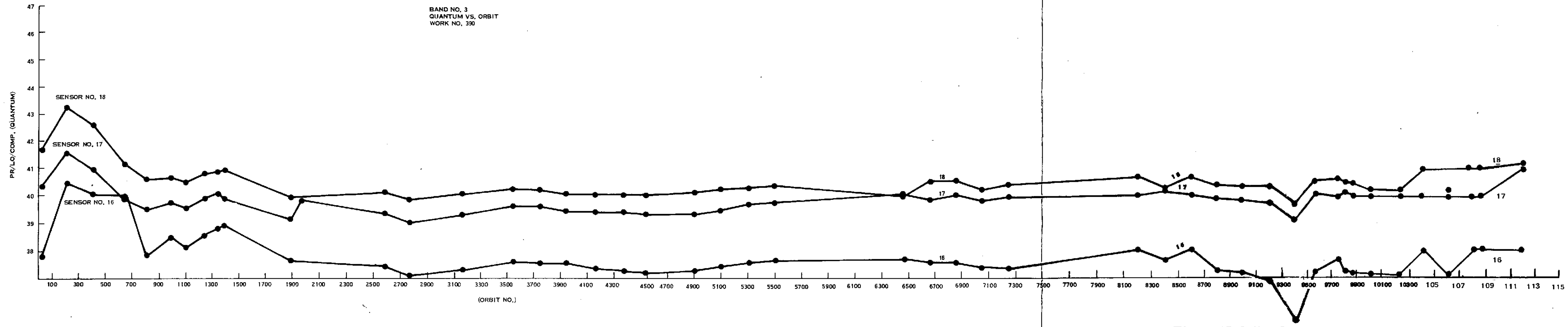

Figure 17-3(6). Quantum vs. Orbit

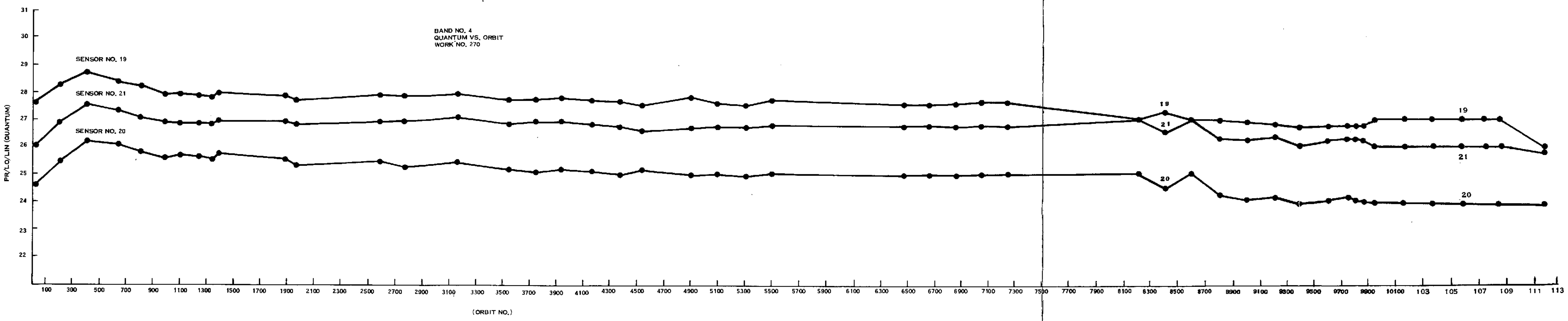

Figure 17-3(7). Quantum vs. Orbit

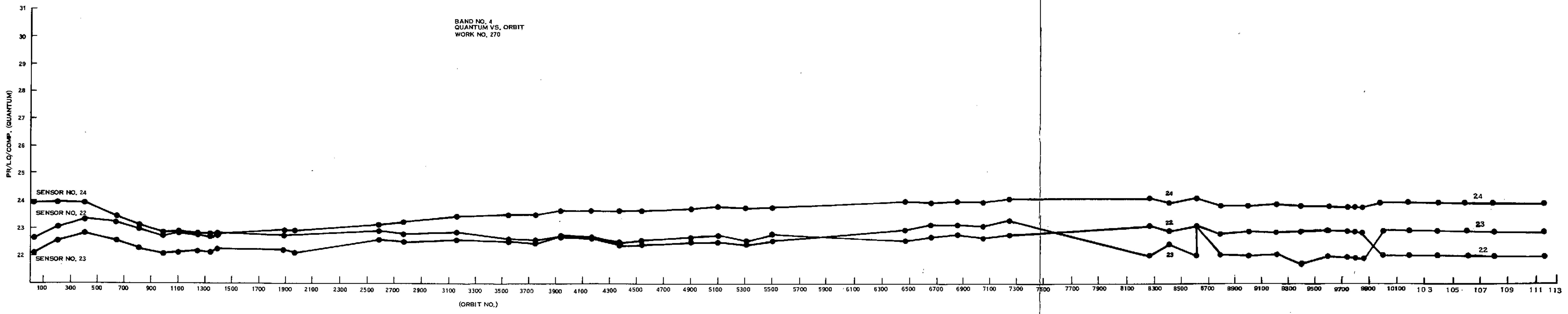

Figure 17-3(8). Quantum vs. Orbit

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The response of this sensor has gradually increased about 15%, so that it saturates at a lower radiance level than the other sensors, posing a processing problem for high radiance scenes (clouds, snow and sometimes desert). The history of Line Length Word vs. Orbit Number is shown in Figure 17-4. It is satisfactory and stable.

Sun calibrations are performed every two weeks (see Table 17-2) and continue to show normal performance. The 82 Sun Calibration Orbits are listed in Table 17-2.

Table 17-2. Sun Calibration Orbits

21	1012	2278	4161	6657	8943	10366
47	1207	2375	4370	6852	8999	10561
89	1303	2389	4537	7047	9208	10756
103	1400	2473	4705	7242	9389	10951
131	1497	2585	4900	7437	9585	11161
214	1595	2668	5095	7633	9724	11331
326	1692	2766	5304	7829	9766	
423	1790	2964	5499	8038	9808	
521	1877	3159	5861	8220	9850	
619	1985	3351	5891	8413	9892	
730	2082	3543	6072	8608	9975	
814	2166	3742	6268	8803	10171	
915	2180	3938	6463			

Except for a temporary decrease of cal wedge sensitivity in the vicinity of Orbits 9200/9400, performance has been exceptional. There may have been a decrease in SNM (signal-to-noise at level 63) for some of the sensors over time in orbit, but even if true, the decrease is small. There are no factors evident which would preclude continued use of the data with confidence.

SECTION 18

DATA COLLECTION SUBSYSTEM

SECTION 18

DATA COLLECTION SUBSYSTEM

The Data Collection Subsystem (DCS) has operated satisfactorily since turn-ON in Orbit 5. External interference is minimal and has not affected data collection during this reporting period.

Only Receiver 1 has been used to date. Since turn-ON this receiver has operated for 19,704.6 hours continuously, except for an interruption of 11 hours because of ACS problems on September 29, 1974 during Orbits 11125 to 11132.

Since turn-ON in Orbit 5, this subsystem has received 1,058,746 messages, of which 973,491 (91.9%) have been perfect. Periods of heavy interference have added false messages to both "total" messages and "imperfect" messages, diluting the apparent "error" rate, and making the percent perfect figure an unreliable figure of merit.

All telemetry functions have been normal as shown in the typical values of Table 18-1.

Table 18-1. DCS Telemetry Values

No.	Name	Units	Value in Orbits						
			15	2599	4811	10182	10592	11032	11456
16001	Revr 1 Sig Str	(DBM)	-124.09	-124.39	-123.36	-123.63	-123.52	-123.16	124.86
16002	Revr 1 Temp	(DGC)	22.72	24.07	23.74	23.71	23.65	23.66	24.19
16003	Revr 1 Inp Volt	(VDC)	12.02	12.02	12.01	12.02	12.02	12.02	12.01

Figure 18-1 shows the total number of DCS messages received per 18-day cycle since launch. The number of active platforms is also plotted on the same time scale. It can be seen that when the number of active platforms reached about 100, the DCS messages received per 18-day cycle reached 28 thousand for about 9 months, decreased with the USB power drop then rose to about 23 thousand messages per 18-day cycle.

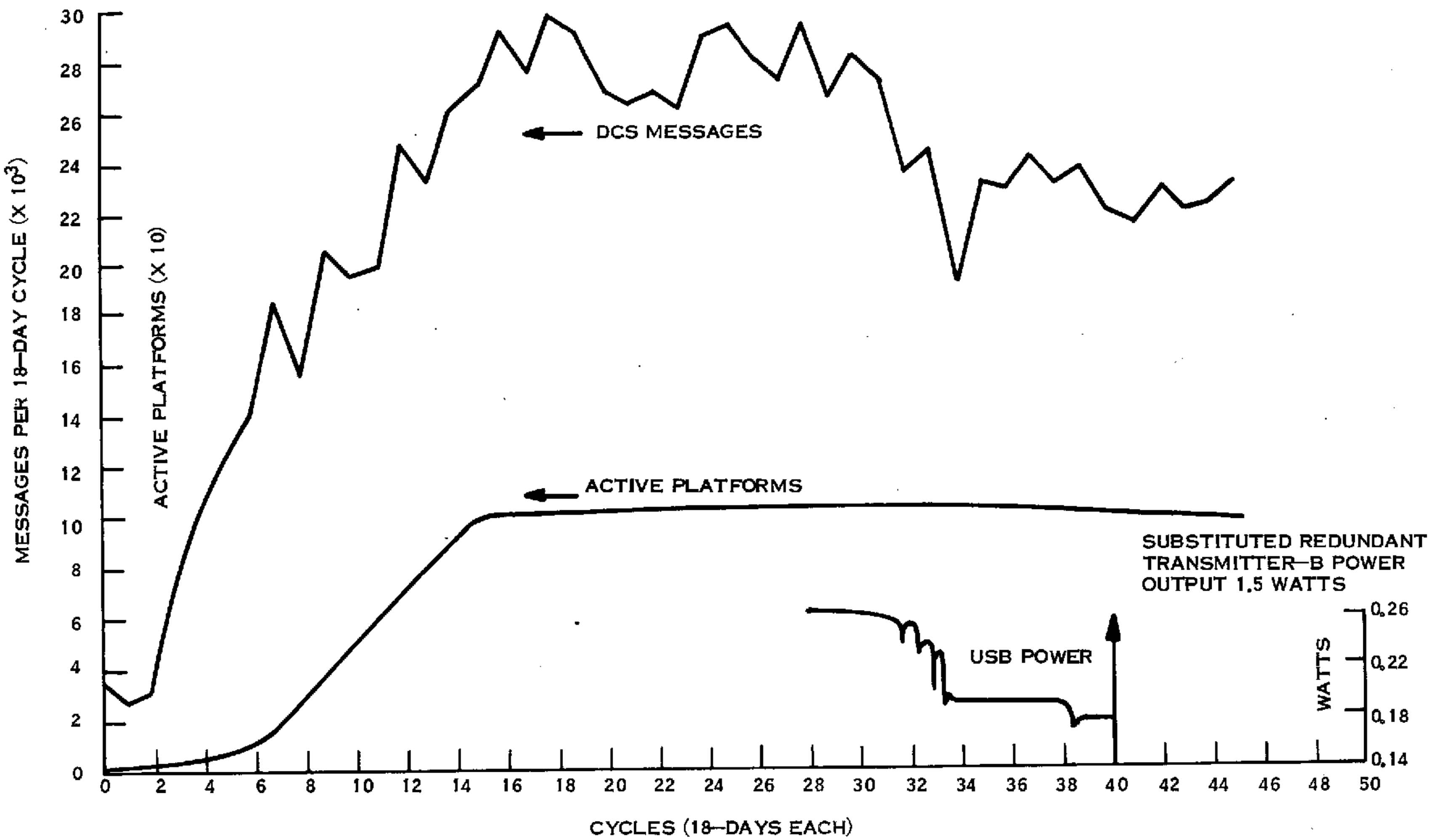

Figure 18-1. DCS Message Receipt Message

Table 18-2 shows the qualitative performance of the DCS subsystem and Table 18-3 gives statistics of messages received.

Table 18-2. DCS Qualitative Performance

System Threshold	3500 km
Grazing Angle Effects	Not discernible
Adjacent DCP Interference	Not seen
Ground Transmission System	Satisfactory
Probability of Perfect Reception of any Messages During Window*	98.9%

* Window means "at times when the spacecraft is simultaneously within the horizon of the DCP and the ground receiving station".

Table 18-3. DCS Statistics

Through Orbit 8911	
DCS Platforms (DCP's) Shipped	224
Maximum DCP's Received per Day	107
Total Messages Received at OCC	1,058,746
Total Messages Rejected at OCC	82,255
For This Quarter	
Maximum Messages per day (5/25/74)	1523
Number of Orbits with Message Counts Exceeding:	
400	26
500	0
Number of Current Users	43

APPENDIX A

ERTS-1 ANOMALY LIST

OBSERVATORY ANOMALIES AND OBSERVATIONS

Date	Anomaly/Observation	How Observed	Comments
7/24/72	Sun Sensor Temperature High	Off-Line	No Action Required For ERTS-1; ERTS-B Redesigned
7/24/72	Solar Paddle Temperature Excursions Greater Than Expected	Off-Line	No Action Required For ERTS-1; Math Model Corrected
7/25/72	USB Power Output Decreasing	Off-Line	Switched to Side B in Orbit 10068 on 7/15/74. Under investigation for ERTS-B. No power drops in USB side B.
8/03/72	WBVTR No. 2 Power Converter Shorted	Real Time & Off-Line	Turned All P/L Off During Pass. Formed NASA/GE/RCA Evaluation Committee. Disconnected since Anomaly. Redesigned For ERTS-B
8/03/72	Decrease in Solar Array Current	Off-Line	Evaluate Degradation Effect Due to Solar Flare Activity
8/06/72	RBV Power Transient PSM Turn-Off Failure	Real Time	Turned off PRM. NASA/GE, RCA Evaluation Committee Formed; Disconnected Since Anomaly; Redesign PSM For ERTS-B
8/10/72	DCS Reject Messages Rose to Over 40% of Total Messages for 15 Days	Off-Line	External Interference; Located Source; No Serious Interference Since.
8/10/72	MSS Cal Wedge Levels Decreasing	Off-Line	Leveled Off After Orbit 1000; At Or About 5% Below Earlier Values
8/03/72	Incorrect Time Tags in Comstor 'B' Cell 12	Real Time	Reload Comstors and Verify; (Discontinued Actuve Use of Cell 12)
12/04/72 12/06/72	Pitch Roll Yaw Motor Drive Duty Cycles Increased for Short Period	Off-Line	Evaluate - Prepared Contingency Plan Under Investigation For ERTS-B
3/29/73	WBVTR NO. 1; High BER	Real Time	Formed NASA/GE/RCA Committee; Lapped Heads; Now in Operational Use. Temporarily Restricted to Last 600 Feet (600 Seconds) of Tape
4/08/72	Slow Leak in Forward IR Scanner Pressure	Off-Line	Not Expected to Interfere with Normal Operations
5/20/72	Defect in Signal of Left Cosine Pot at S/C Midmight	Off-Line	Not Expected to Interfere with Normal Operations
6/03/73	Failure of Integrated Circuit Chip and TLM of Functions 6012, 1011, 12238 and 7010	Real Time & Off-Line	Tlm Failure only. S/C Operations Normal
11/5/73	WBVTR-1 Tape Unit Pressure Drop	Real Time	Defect in Pressure Instrumentation which Causes Occasional Rapid Pressure Drop in TLM - Returns to Normal
11/13/73	Solar Array Drive	Real Time	Slight Peaks on Drive Voltage Ripple which Picked up Limit Flag - Returned to Normal
11/28/73	High Head Wheel Current, WBVTR-1, During Rewind	Real Time	Resumed Operations After Investigation WBVTR-1 Performed in a Nominal Manner
12/20/73	Pitch Motor Driver Duty Cycle Increased	Real Time	Similar to Entry 12/4/72 except more Sustained
12/22/73	RMP-1 and RMP-2 Showed Excessive Noise/Output	Real Time	Condition Lasted for Several Orbits and Returned to Normal
2/20/74	Pitch Wheel Stopped During Sun Transient	Off-Line	During a sun transient in orbit 8040 the pitch flywheel was changing directions. As it passed thru zero speed, the pitch flywheel stopped and did not resume operation until 2 minutes had elapsed in spite of application of 100% clockwise pitch motor driver duty cycle during that interval.
3/5/74	WBTR #1 High BER HIGH HW-1	Real Time & Off-Line	Limited Usage of Tape Footage
3/7/74	WBVTR-1-high HWI	Real Time & Off-Line	Suspended operation pending study
3/21/74	WBVTR-1-high HWI	Real Time & Off-Line	Suspended operation pending study
3/27/74	WBVTR-1-MFSE count high	Off-Line	Suspended operation pending study
4/2/74	WBVTR-1-MFSE count high	Off-Line	Suspended operation pending study
5/21/74	Pitch CCW Motor Driver Duty Cycle Increased	Real Time & Off-Line	Similiar to 12/4/72 entry. Returned to normal.
7/2/74	Pitch CCW Motor Driver Duty Cycle Increased	Real Time & Off-Line	Similiar to 12/4/72 entry. Returned to normal.
7/2/74	WBVTR-1-high HWI and MFSE	Real Time & Off-Line	Suspended operation pending study
8/6/74	Pitch CCW Motor Driver Duty Cycle Increase	Real Time & Off-Line	Similar to 12/4/72 entry. Returned to Normal.
8/21/74	Pitch CCW Motor Driver Duty Cycle Increase	Real Time & Off-Line	Similar to 12/4/74 entry. Returned to Normal.
8/28/74	Pitch CCW Motor Driver Duty Cycle Increase	Real Time & Off-Line	Silimar to 12/4/74 entry. Returned to Normal.
9/4/74	Pitch CCW Motor Driver Duty Cycle Increase	Real Time & Off-Line	Silimar to 12/4/72 entry. Returned to Normal.
9/9/74	Pitch CCW Motor Driver Duty Cycle Increase	Real Time & Off-Line	Similar to 12/4/72 entry. Returned to Normal.
9/14/74	PSM Power Regulator Switchover From 1 to 2	Real Time	VHF interference signal present. Occurred at 02:46:21. Spacecraft was normal.
9/23/74	PSM Power Regulator Switchover From 2 to 1	Real Time	VHF interference signal present. Occurred 01:49:17. Spacecraft is normal
9/25/74	Pitch CCW Motor Driver Duty Cycle Increase	Real Time & Off-Line	Silimar to 12/4/72 entry. Returned to Normal.
9/29/74	Pitch Flywheel Stopped	Real Time	The pitch CCW motor driver duty cycle began increasing in orbit 11120. The pitch flywheel stopped (from 400 RPM) following a sun transient in orbit 11125. After a period of approximately 8 hours, and attitude disturbances, the pitch flywheel restarted. Earth acquisition was obtained and operations returned to normal in orbit 11133.
10/9/74	RMP B Motor Current Variations	Off-Line & Real Time	As a precautionary measure a switch was made to RMP A. RMP B is still functioning and can be used in the event of RMP A failure.
			Switched to Side B in Orbit 10068 on 7/15/74. Under investigation for ERTS-B. No power drops in USB side B.

APPENDIX B

ERTS-1 GROUND TRACE REPEAT CYCLE PREDICTION TABLE

SPACECRAFT ORBIT REFERENCE TABLES

FROM JUNE 1974 THRU SEPTEMBER 1975

ORBIT 9445 THRU 15928

FLIGHT DAY 678 THRU 1142

JUN, 1974

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	152	678	9445- 9458	43- 56	4	38
2	153	679	9459- 9472	57- 70	5	38
3	154	680	9473- 9486	71- 84	6	38
4	155	681	9487- 9500	85- 98	7	38
5	156	682	9501- 9513	99-111	8	38
6	157	683	9514- 9527	112-125	9	38
7	158	684	9528- 9541	126-139	10	38
8	159	685	9542- 9555	140-153	11	38
9	160	686	9556- 9569	154-167	12	38
10	161	687	9570- 9583	168-181	13	38
11	162	688	9584- 9597	182-195	14	38
12	163	689	9598- 9611	196-209	15	38
13	164	690	9612- 9625	210-223	16	38
14	165	691	9626- 9639	224-237	17	38
15	166	692	9640- 9653	238-251	18	38
16	167	693	9654- 9667	1- 14	1	39
17	168	694	9668- 9681	15- 28	2	39
18	169	695	9682- 9695	29- 42	3	39
19	170	696	9696- 9709	43- 56	4	39
20	171	697	9710- 9723	57- 70	5	39
21	172	698	9724- 9737	71- 84	6	39
22	173	699	9738- 9751	85- 98	7	39
23	174	700	9752- 9764	99-111	8	39
24	175	701	9765- 9778	112-125	9	39
25	176	702	9779- 9792	126-139	10	39
26	177	703	9793- 9806	140-153	11	39
27	178	704	9807- 9820	154-167	12	39
28	179	705	9821- 9834	168-181	13	39
29	180	706	9835- 9848	182-195	14	39
30	181	707	9849- 9862	196-209	15	39

JUL 1974

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	182	708	9863- 9876	210-223	16	39
2	183	709	9877- 9890	224-237	17	39
3	184	710	9891- 9904	238-251	18	39
4	185	711	9905- 9918	1- 14	1	40
5	186	712	9919- 9932	15- 28	2	40
6	187	713	9933- 9946	29- 42	3	40
7	188	714	9947- 9960	43- 56	4	40
8	189	715	9961- 9974	57- 70	5	40
9	190	716	9975- 9988	71- 84	6	40
10	191	717	9989-10002	85- 98	7	40
11	192	718	10003-10015	99-111	8	40
12	193	719	10016-10029	112-125	9	40
13	194	720	10030-10043	126-139	10	40
14	195	721	10044-10057	140-153	11	40
15	196	722	10058-10071	154-167	12	40
16	197	723	10072-10085	168-181	13	40
17	198	724	10086-10099	182-195	14	40
18	199	725	10100-10113	196-209	15	40
19	200	726	10114-10127	210-223	16	40
20	201	727	10128-10141	224-237	17	40
21	202	728	10142-10155	238-251	18	40
22	203	729	10156-10169	1- 14	1	41
23	204	730	10170-10183	15- 28	2	41
24	205	731	10184-10197	29- 42	3	41
25	206	732	10198-10211	43- 56	4	41
26	207	733	10212-10225	57- 70	5	41
27	208	734	10226-10239	71- 84	6	41
28	209	735	10240-10253	85- 98	7	41
29	210	736	10254-10266	99-111	8	41
30	211	737	10267-10280	112-125	9	41
31	212	738	10281-10294	126-139	10	41

AUG,1974

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	213	739	10295-10308	140-153	11	41
2	214	740	10309-10322	154-167	12	41
3	215	741	10323-10336	168-181	13	41
4	216	742	10337-10350	182-195	14	41
5	217	743	10351-10364	196-209	15	41
6	218	744	10365-10378	210-223	16	41
7	219	745	10379-10392	224-237	17	41
8	220	746	10393-10406	238-251	18	41
9	221	747	10407-10420	1- 14	1	42
10	222	748	10421-10434	15- 28	2	42
11	223	749	10435-10448	29- 42	3	42
12	224	750	10449-10462	43- 56	4	42
13	225	751	10463-10476	57- 70	5	42
14	226	752	10477-10490	71- 84	6	42
15	227	753	10491-10504	85- 98	7	42
16	228	754	10505-10517	99-111	8	42
17	229	755	10518-10531	112-125	9	42
18	230	756	10532-10545	126-139	10	42
19	231	757	10546-10559	140-153	11	42
20	232	758	10560-10573	154-167	12	42
21	233	759	10574-10587	168-181	13	42
22	234	760	10588-10601	182-195	14	42
23	235	761	10602-10615	196-209	15	42
24	236	762	10616-10629	210-223	16	42
25	237	763	10630-10643	224-237	17	42
26	238	764	10644-10657	238-251	18	42
27	239	765	10658-10671	1- 14	1	43
28	240	766	10672-10685	15- 28	2	43
29	241	767	10686-10699	29- 42	3	43
30	242	768	10700-10713	43- 56	4	43
31	243	769	10714-10727	57- 70	5	43

SEP,1974

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	244	770	10728-10741	71- 84	6	43
2	245	771	10742-10755	85- 98	7	43
3	246	772	10756-10768	99-111	8	43
4	247	773	10769-10782	112-125	9	43
5	248	774	10783-10796	126-139	10	43
6	249	775	10797-10810	140-153	11	43
7	250	776	10811-10824	154-167	12	43
8	251	777	10825-10838	168-181	13	43
9	252	778	10839-10852	182-195	14	43
10	253	779	10853-10866	196-209	15	43
11	254	780	10867-10880	210-223	16	43
12	255	781	10881-10894	224-237	17	43
13	256	782	10895-10908	238-251	18	43
14	257	783	10909-10922	1- 14	1	44
15	258	784	10923-10936	15- 28	2	44
16	259	785	10937-10950	29- 42	3	44
17	260	786	10951-10964	43- 56	4	44
18	261	787	10965-10978	57- 70	5	44
19	262	788	10979-10992	71- 84	6	44
20	263	789	10993-11006	85- 98	7	44
21	264	790	11007-11019	99-111	8	44
22	265	791	11020-11033	112-125	9	44
23	266	792	11034-11047	126-139	10	44
24	267	793	11048-11061	140-153	11	44
25	268	794	11062-11075	154-167	12	44
26	269	795	11076-11089	168-181	13	44
27	270	796	11090-11103	182-195	14	44
28	271	797	11104-11117	196-209	15	44
29	272	798	11118-11131	210-223	16	44
30	273	799	11132-11145	224-237	17	44

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ØCT,1974

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ØRBITS	REFERENCE ØRBITS	REF DAY	CYCLE NØ.
1	274	800	11146-11159	238-251	18	44
2	275	801	11160-11173	1- 14	1	45
3	276	802	11174-11187	15- 28	2	45
4	277	803	11188-11201	29- 42	3	45
5	278	804	11202-11215	43- 56	4	45
6	279	805	11216-11229	57- 70	5	45
7	280	806	11230-11243	71- 84	6	45
8	281	807	11244-11257	85- 98	7	45
9	282	808	11258-11270	99-111	8	45
10	283	809	11271-11284	112-125	9	45
11	284	810	11285-11298	126-139	10	45
12	285	811	11299-11312	140-153	11	45
13	286	812	11313-11326	154-167	12	45
14	287	813	11327-11340	168-181	13	45
15	288	814	11341-11354	182-195	14	45
16	289	815	11355-11368	196-209	15	45
17	290	816	11369-11382	210-223	16	45
18	291	817	11383-11396	224-237	17	45
19	292	818	11397-11410	238-251	18	45
20	293	819	11411-11424	1- 14	1	46
21	294	820	11425-11438	15- 28	2	46
22	295	821	11439-11452	29- 42	3	46
23	296	822	11453-11466	43- 56	4	46
24	297	823	11467-11480	57- 70	5	46
25	298	824	11481-11494	71- 84	6	46
26	299	825	11495-11508	85- 98	7	46
27	300	826	11509-11521	99-111	8	46
28	301	827	11522-11535	112-125	9	46
29	302	828	11536-11549	126-139	10	46
30	303	829	11550-11563	140-153	11	46
31	304	830	11564-11577	154-167	12	46

NOV, 1974

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	305	831	11578-11591	168-181	13	46
2	306	832	11592-11605	182-195	14	46
3	307	833	11606-11619	196-209	15	46
4	308	834	11620-11633	210-223	16	46
5	309	835	11634-11647	224-237	17	46
6	310	836	11648-11661	238-251	18	46
7	311	837	11662-11675	1- 14	1	47
8	312	838	11676-11689	15- 28	2	47
9	313	839	11690-11703	29- 42	3	47
10	314	840	11704-11717	43- 56	4	47
11	315	841	11718-11731	57- 70	5	47
12	316	842	11732-11745	71- 84	6	47
13	317	843	11746-11759	85- 98	7	47
14	318	844	11760-11772	99-111	8	47
15	319	845	11773-11786	112-125	9	47
16	320	846	11787-11800	126-139	10	47
17	321	847	11801-11814	140-153	11	47
18	322	848	11815-11828	154-167	12	47
19	323	849	11829-11842	168-181	13	47
20	324	850	11843-11856	182-195	14	47
21	325	851	11857-11870	196-209	15	47
22	326	852	11871-11884	210-223	16	47
23	327	853	11885-11898	224-237	17	47
24	328	854	11899-11912	238-251	18	47
25	329	855	11913-11926	1- 14	1	48
26	330	856	11927-11940	15- 28	2	48
27	331	857	11941-11954	29- 42	3	48
28	332	858	11955-11968	43- 56	4	48
29	333	859	11969-11982	57- 70	5	48
30	334	860	11983-11996	71- 84	6	48

DEC,1974

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	335	861	11997-12010	85- 98	7	48
2	336	862	12011-12023	99-111	8	48
3	337	863	12024-12037	112-125	9	48
4	338	864	12038-12051	126-139	10	48
5	339	865	12052-12065	140-153	11	48
6	340	866	12066-12079	154-167	12	48
7	341	867	12080-12093	168-181	13	48
8	342	868	12094-12107	182-195	14	48
9	343	869	12108-12121	196-209	15	48
10	344	870	12122-12135	210-223	16	48
11	345	871	12136-12149	224-237	17	48
12	346	872	12150-12163	238-251	18	48
13	347	873	12164-12177	1- 14	1	49
14	348	874	12178-12191	15- 28	2	49
15	349	875	12192-12205	29- 42	3	49
16	350	876	12206-12219	43- 56	4	49
17	351	877	12220-12233	57- 70	5	49
18	352	878	12234-12247	71- 84	6	49
19	353	879	12248-12261	85- 98	7	49
20	354	880	12262-12274	99-111	8	49
21	355	881	12275-12288	112-125	9	49
22	356	882	12289-12302	126-139	10	49
23	357	883	12303-12316	140-153	11	49
24	358	884	12317-12330	154-167	12	49
25	359	885	12331-12344	168-181	13	49
26	360	886	12345-12358	182-195	14	49
27	361	887	12359-12372	196-209	15	49
28	362	888	12373-12386	210-223	16	49
29	363	889	12387-12400	224-237	17	49
30	364	890	12401-12414	238-251	18	49
31	365	891	12415-12428	1- 14	1	50

JAN, 1975

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	1	892	12429-12442	15- 28	2	50
2	2	893	12443-12456	29- 42	3	50
3	3	894	12457-12470	43- 56	4	50
4	4	895	12471-12484	57- 70	5	50
5	5	896	12485-12498	71- 84	6	50
6	6	897	12499-12512	85- 98	7	50
7	7	898	12513-12525	99-111	8	50
8	8	899	12526-12539	112-125	9	50
9	9	900	12540-12553	126-139	10	50
10	10	901	12554-12567	140-153	11	50
11	11	902	12568-12581	154-167	12	50
12	12	903	12582-12595	168-181	13	50
13	13	904	12596-12609	182-195	14	50
14	14	905	12610-12623	196-209	15	50
15	15	906	12624-12637	210-223	16	50
16	16	907	12638-12651	224-237	17	50
17	17	908	12652-12665	238-251	18	50
18	18	909	12666-12679	1- 14	1	51
19	19	910	12680-12693	15- 28	2	51
20	20	911	12694-12707	29- 42	3	51
21	21	912	12708-12721	43- 56	4	51
22	22	913	12722-12735	57- 70	5	51
23	23	914	12736-12749	71- 84	6	51
24	24	915	12750-12763	85- 98	7	51
25	25	916	12764-12776	99-111	8	51
26	26	917	12777-12790	112-125	9	51
27	27	918	12791-12804	126-139	10	51
28	28	919	12805-12818	140-153	11	51
29	29	920	12819-12832	154-167	12	51
30	30	921	12833-12846	168-181	13	51
31	31	922	12847-12860	182-195	14	51

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FEB,1975

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	32	923	12861-12874	196-209	15	51
2	33	924	12875-12888	210-223	16	51
3	34	925	12889-12902	224-237	17	51
4	35	926	12903-12916	238-251	18	51
5	36	927	12917-12930	1- 14	1	52
6	37	928	12931-12944	15- 28	2	52
7	38	929	12945-12958	29- 42	3	52
8	39	930	12959-12972	43- 56	4	52
9	40	931	12973-12986	57- 70	5	52
10	41	932	12987-13000	71- 84	6	52
11	42	933	13001-13014	85- 98	7	52
12	43	934	13015-13027	99-111	8	52
13	44	935	13028-13041	112-125	9	52
14	45	936	13042-13055	126-139	10	52
15	46	937	13056-13069	140-153	11	52
16	47	938	13070-13083	154-167	12	52
17	48	939	13084-13097	168-181	13	52
18	49	940	13098-13111	182-195	14	52
19	50	941	13112-13125	196-209	15	52
20	51	942	13126-13139	210-223	16	52
21	52	943	13140-13153	224-237	17	52
22	53	944	13154-13167	238-251	18	52
23	54	945	13168-13181	1- 14	1	53
24	55	946	13182-13195	15- 28	2	53
25	56	947	13196-13209	29- 42	3	53
26	57	948	13210-13223	43- 56	4	53
27	58	949	13224-13237	57- 70	5	53
28	59	950	13238-13251	71- 84	6	53

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	60	951	13252-13265	85- 98	7	53
2	61	952	13266-13278	99-111	8	53
3	62	953	13279-13292	112-125	9	53
4	63	954	13293-13306	126-139	10	53
5	64	955	13307-13320	140-153	11	53
6	65	956	13321-13334	154-167	12	53
7	66	957	13335-13348	168-181	13	53
8	67	958	13349-13362	182-195	14	53
9	68	959	13363-13376	196-209	15	53
10	69	960	13377-13390	210-223	16	53
11	70	961	13391-13404	224-237	17	53
12	71	962	13405-13418	238-251	18	53
13	72	963	13419-13432	1- 14	1	54
14	73	964	13433-13446	15- 28	2	54
15	74	965	13447-13460	29- 42	3	54
16	75	966	13461-13474	43- 56	4	54
17	76	967	13475-13488	57- 70	5	54
18	77	968	13489-13502	71- 84	6	54
19	78	969	13503-13516	85- 98	7	54
20	79	970	13517-13529	99-111	8	54
21	80	971	13530-13543	112-125	9	54
22	81	972	13544-13557	126-139	10	54
23	82	973	13558-13571	140-153	11	54
24	83	974	13572-13585	154-167	12	54
25	84	975	13586-13599	168-181	13	54
26	85	976	13600-13613	182-195	14	54
27	86	977	13614-13627	196-209	15	54
28	87	978	13628-13641	210-223	16	54
29	88	979	13642-13655	224-237	17	54
30	89	980	13656-13669	238-251	18	54
31	90	981	13670-13683	1- 14	1	55

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APR, 1975

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	91	982	13684-13697	15- 28	2	55
2	92	983	13698-13711	29- 42	3	55
3	93	984	13712-13725	43- 56	4	55
4	94	985	13726-13739	57- 70	5	55
5	95	986	13740-13753	71- 84	6	55
6	96	987	13754-13767	85- 98	7	55
7	97	988	13768-13780	99-111	8	55
8	98	989	13781-13794	112-125	9	55
9	99	990	13795-13808	126-139	10	55
10	100	991	13809-13822	140-153	11	55
11	101	992	13823-13836	154-167	12	55
12	102	993	13837-13850	168-181	13	55
13	103	994	13851-13864	182-195	14	55
14	104	995	13865-13878	196-209	15	55
15	105	996	13879-13892	210-223	16	55
16	106	997	13893-13906	224-237	17	55
17	107	998	13907-13920	238-251	18	55
18	108	999	13921-13934	1- 14	1	56
19	109	1000	13935-13948	15- 28	2	56
20	110	1001	13949-13962	29- 42	3	56
21	111	1002	13963-13976	43- 56	4	56
22	112	1003	13977-13990	57- 70	5	56
23	113	1004	13991-14004	71- 84	6	56
24	114	1005	14005-14018	85- 98	7	56
25	115	1006	14019-14031	99-111	8	56
26	116	1007	14032-14045	112-125	9	56
27	117	1008	14046-14059	126-139	10	56
28	118	1009	14060-14073	140-153	11	56
29	119	1010	14074-14087	154-167	12	56
30	120	1011	14088-14101	168-181	13	56

MAY, 1975

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	121	1012	14102-14115	182-195	14	56
2	122	1013	14116-14129	196-209	15	56
3	123	1014	14130-14143	210-223	16	56
4	124	1015	14144-14157	224-237	17	56
5	125	1016	14158-14171	238-251	18	56
6	126	1017	14172-14185	1- 14	1	57
7	127	1018	14186-14199	15- 28	2	57
8	128	1019	14200-14213	29- 42	3	57
9	129	1020	14214-14227	43- 56	4	57
10	130	1021	14228-14241	57- 70	5	57
11	131	1022	14242-14255	71- 84	6	57
12	132	1023	14256-14269	85- 98	7	57
13	133	1024	14270-14282	99-111	8	57
14	134	1025	14283-14296	112-125	9	57
15	135	1026	14297-14310	126-139	10	57
16	136	1027	14311-14324	140-153	11	57
17	137	1028	14325-14338	154-167	12	57
18	138	1029	14339-14352	168-181	13	57
19	139	1030	14353-14366	182-195	14	57
20	140	1031	14367-14380	196-209	15	57
21	141	1032	14381-14394	210-223	16	57
22	142	1033	14395-14408	224-237	17	57
23	143	1034	14409-14422	238-251	18	57
24	144	1035	14423-14436	1- 14	1	58
25	145	1036	14437-14450	15- 28	2	58
26	146	1037	14451-14464	29- 42	3	58
27	147	1038	14465-14478	43- 56	4	58
28	148	1039	14479-14492	57- 70	5	58
29	149	1040	14493-14506	71- 84	6	58
30	150	1041	14507-14520	85- 98	7	58
31	151	1042	14521-14533	99-111	8	58

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DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	152	1043	14534-14547	112-125	9	58
2	153	1044	14548-14561	126-139	10	58
3	154	1045	14562-14575	140-153	11	58
4	155	1046	14576-14589	154-167	12	58
5	156	1047	14590-14603	168-181	13	58
6	157	1048	14604-14617	182-195	14	58
7	158	1049	14618-14631	196-209	15	58
8	159	1050	14632-14645	210-223	16	58
9	160	1051	14646-14659	224-237	17	58
10	161	1052	14660-14673	238-251	18	58
11	162	1053	14674-14687	1- 14	1	59
12	163	1054	14688-14701	15- 28	2	59
13	164	1055	14702-14715	29- 42	3	59
14	165	1056	14716-14729	43- 56	4	59
15	166	1057	14730-14743	57- 70	5	59
16	167	1058	14744-14757	71- 84	6	59
17	168	1059	14758-14771	85- 98	7	59
18	169	1060	14772-14784	99-111	8	59
19	170	1061	14785-14798	112-125	9	59
20	171	1062	14799-14812	126-139	10	59
21	172	1063	14813-14826	140-153	11	59
22	173	1064	14827-14840	154-167	12	59
23	174	1065	14841-14854	168-181	13	59
24	175	1066	14855-14868	182-195	14	59
25	176	1067	14869-14882	196-209	15	59
26	177	1068	14883-14896	210-223	16	59
27	178	1069	14897-14910	224-237	17	59
28	179	1070	14911-14924	238-251	18	59
29	180	1071	14925-14938	1- 14	1	60
30	181	1072	14939-14952	15- 28	2	60

JUL,1975

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	182	1073	14953-14966	29- 42	3	60
2	183	1074	14967-14980	43- 56	4	60
3	184	1075	14981-14994	57- 70	5	60
4	185	1076	14995-15008	71- 84	6	60
5	186	1077	15009-15022	85- 98	7	60
6	187	1078	15023-15035	99-111	8	60
7	188	1079	15036-15049	112-125	9	60
8	189	1080	15050-15063	126-139	10	60
9	190	1081	15064-15077	140-153	11	60
10	191	1082	15078-15091	154-167	12	60
11	192	1083	15092-15105	168-181	13	60
12	193	1084	15106-15119	182-195	14	60
13	194	1085	15120-15133	196-209	15	60
14	195	1086	15134-15147	210-223	16	60
15	196	1087	15148-15161	224-237	17	60
16	197	1088	15162-15175	238-251	18	60
17	198	1089	15176-15189	1- 14	1	61
18	199	1090	15190-15203	15- 28	2	61
19	200	1091	15204-15217	29- 42	3	61
20	201	1092	15218-15231	43- 56	4	61
21	202	1093	15232-15245	57- 70	5	61
22	203	1094	15246-15259	71- 84	6	61
23	204	1095	15260-15273	85- 98	7	61
24	205	1096	15274-15286	99-111	8	61
25	206	1097	15287-15300	112-125	9	61
26	207	1098	15301-15314	126-139	10	61
27	208	1099	15315-15328	140-153	11	61
28	209	1100	15329-15342	154-167	12	61
29	210	1101	15343-15356	168-181	13	61
30	211	1102	15357-15370	182-195	14	61
31	212	1103	15371-15384	196-209	15	61

AUG,1975

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	213	1104	15385-15398	210-223	16	61
2	214	1105	15399-15412	224-237	17	61
3	215	1106	15413-15426	238-251	18	61
4	216	1107	15427-15440	1- 14	1	62
5	217	1108	15441-15454	15- 28	2	62
6	218	1109	15455-15468	29- 42	3	62
7	219	1110	15469-15482	43- 56	4	62
8	220	1111	15483-15496	57- 70	5	62
9	221	1112	15497-15510	71- 84	6	62
10	222	1113	15511-15524	85- 98	7	62
11	223	1114	15525-15537	99-111	8	62
12	224	1115	15538-15551	112-125	9	62
13	225	1116	15552-15565	126-139	10	62
14	226	1117	15566-15579	140-153	11	62
15	227	1118	15580-15593	154-167	12	62
16	228	1119	15594-15607	168-181	13	62
17	229	1120	15608-15621	182-195	14	62
18	230	1121	15622-15635	196-209	15	62
19	231	1122	15636-15649	210-223	16	62
20	232	1123	15650-15663	224-237	17	62
21	233	1124	15664-15677	238-251	18	62
22	234	1125	15678-15691	1- 14	1	63
23	235	1126	15692-15705	15- 28	2	63
24	236	1127	15706-15719	29- 42	3	63
25	237	1128	15720-15733	43- 56	4	63
26	238	1129	15734-15747	57- 70	5	63
27	239	1130	15748-15761	71- 84	6	63
28	240	1131	15762-15775	85- 98	7	63
29	241	1132	15776-15788	99-111	8	63
30	242	1133	15789-15802	112-125	9	63
31	243	1134	15803-15816	126-139	10	63

SEP, 1975

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	244	1135	15817-15830	140-153	11	63
2	245	1136	15831-15844	154-167	12	63
3	246	1137	15845-15858	168-181	13	63
4	247	1138	15859-15872	182-195	14	63
5	248	1139	15873-15886	196-209	15	63
6	249	1140	15887-15900	210-223	16	63
7	250	1141	15901-15914	224-237	17	63
8	251	1142	15915-15928	238-251	18	63

APPENDIX C

PCM UN-COMMANDED SWITCHOVER
PIR-1N23-ERTS-126

GENERAL ELECTRIC
SPACE DIVISION
PHILADELPHIA

PROGRAM INFORMATION REQUEST / RELEASE

PIR NO.	*CLASS. LTR.	OPERATION	PROGRAM	SEQUENCE NO.	REV. LTR.
	U	1N23	ERTS	126	

*USE "C" FOR CLASSIFIED AND "U" FOR UNCLASSIFIED

FROM	TO
K. S. Rizk	T. W. Winchester

DATE SENT	DATE INFO. REQUIRED	PROJECT AND REQ. NO.	REFERENCE DIR. NO.
10/30/74			

SUBJECT

Non-Commanded Switch-Over and Return of Power Control Modules 1 & 2.

INFORMATION REQUESTED/RELEASED

Introduction

On 14 September during Orbit 10910, Power Control Module Regulator No. 1 (PCM-1) was suddenly disconnected from the bus and replaced by PCM-2 without command. Nine days later, on 23 September 1974, Power Control Module Regulator No. 2 was suddenly replaced by PCM-1 without command. Such switchovers could occur by command, by a voltage change of $\pm$ 2 volts for a time duration greater than 70 milliseconds, or by some malfunction.

Conclusion

The switchovers were probably caused by command transients on VHF. Sudden AGC drops of over 16 db were noted at the times of switchover. No power-voltage changes could be found at switchover times, and no other sign of equipment malfunction was evident.

Discussion

The Command and Mode Verify (CMV) computer printout produced after receiving telemetry playback of data in the time interval 01:45:32 to 03:37:32 shows that a switchover from PCM-1 to PCM-2 occurred at 02:46:16 without command. A study of all other records showed no power-voltage or current abnormalities which could have automatically triggered the switch-over. No other equipment irregularity could be found.

An examination of VHF AGC levels show high input signal levels, up to -35 dbm, immediately preceding the switch-over. In the midst of this high level signal, a single 1-second sample showed a AGC level of -60 dbm, a 1-second change of over 16 db. It is probable that the resultant transient in the command receiver triggered the switch-over.

Similarly on 23 September, during Orbit 11035 at 01:49:00 immediately preceding the switch-over, there was a sudden drop in AGC level from -56.6dbm to -76.2 db, a drop of nearly 20 db. It is probable this 1-second transient again triggered the switch-over. Figure 1 is a plot of AGC levels during Orbit 11035.

Figure 2 is a plot of the geography over which these events occurred. The ground trace of Orbit 11035 is shown on the right with the large AGC delta levels shown along the orbit path.

Distribution: L. Gonzales, P. L. Smith, H. Boys, J. Balch, B. Phucas, M. Lamnin, J. Becek, F. Morgan, G. Ehrgott, F. Spollen, R. Davenport, B. Palmer (2), D. Wise, K. Rizk (4)

PAGE NO. ____ OF ____

✓ RETENTION REQUIREMENTS

COPIES FOR	MASTERS FOR
☐ 1 MO.	☐ 3 MOS.
☐ 3 MOS.	☐ 6 MOS.
☐ 6 MOS.	☐ 12 MOS.
☐ MOS.	☐ MOS.
☐	☐ DO NOT DESTROY

FORM 1020 B REV. (9-70)

The geographic location of the switch-over during Orbit 10910 is also shown in upper left.

K. S. Rizk

K. S. Rizk
Systems Engineer

KSR/mhl

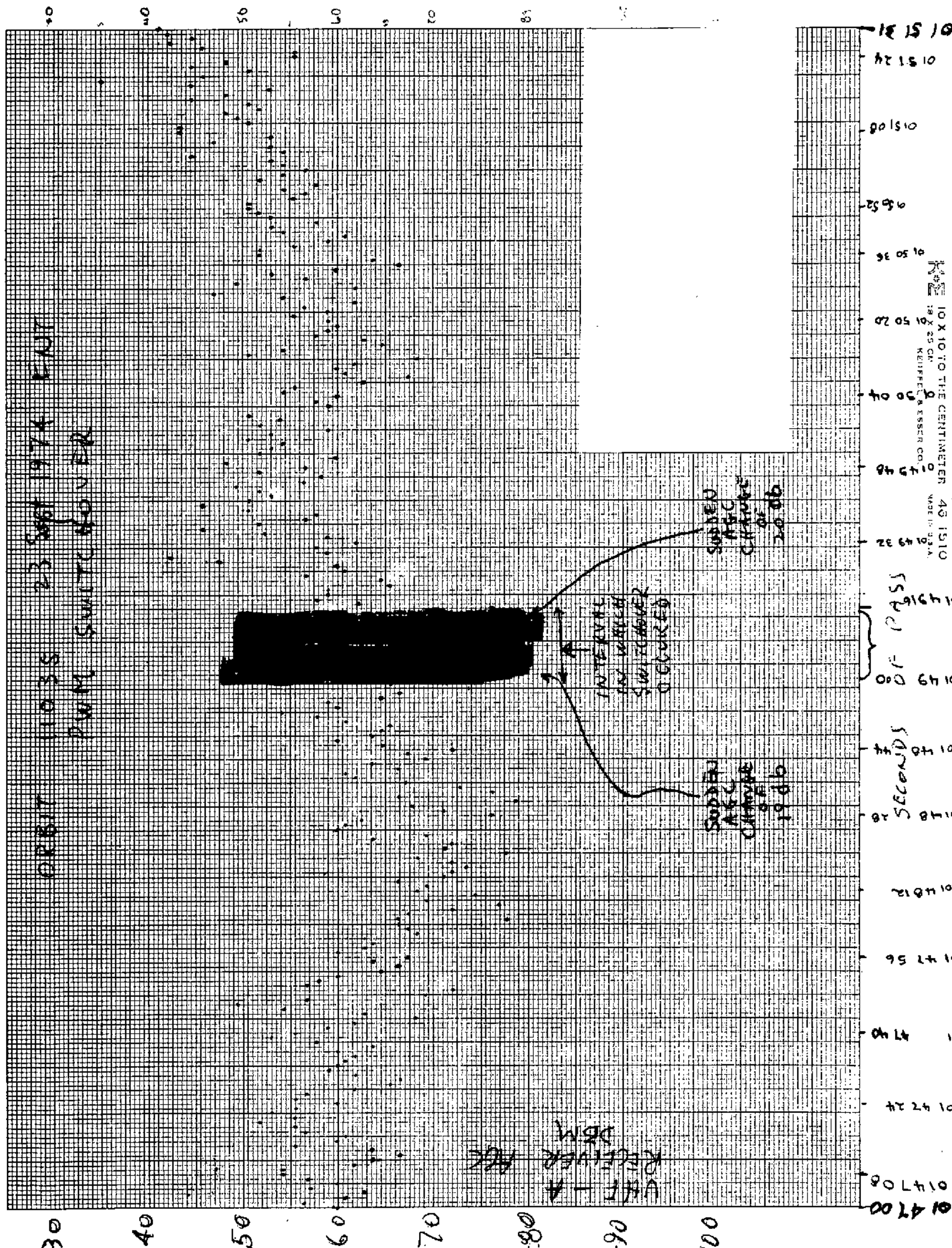

Figure C-1. VHF-AGC Levels During PCM Regulator Switchover in Orbit 11035

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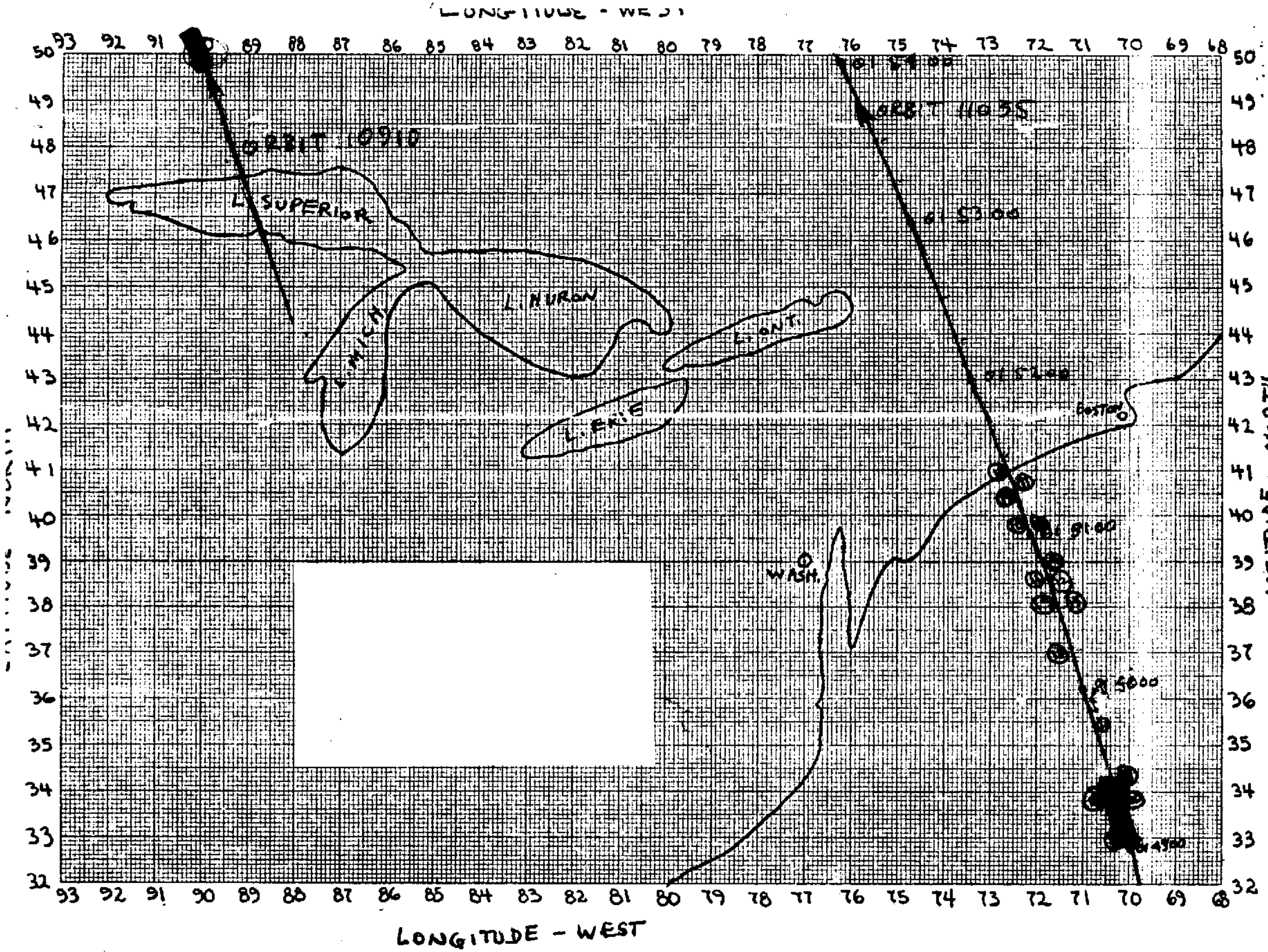

Figure C-2. Geographic Position of PCM Regulator Switchovers